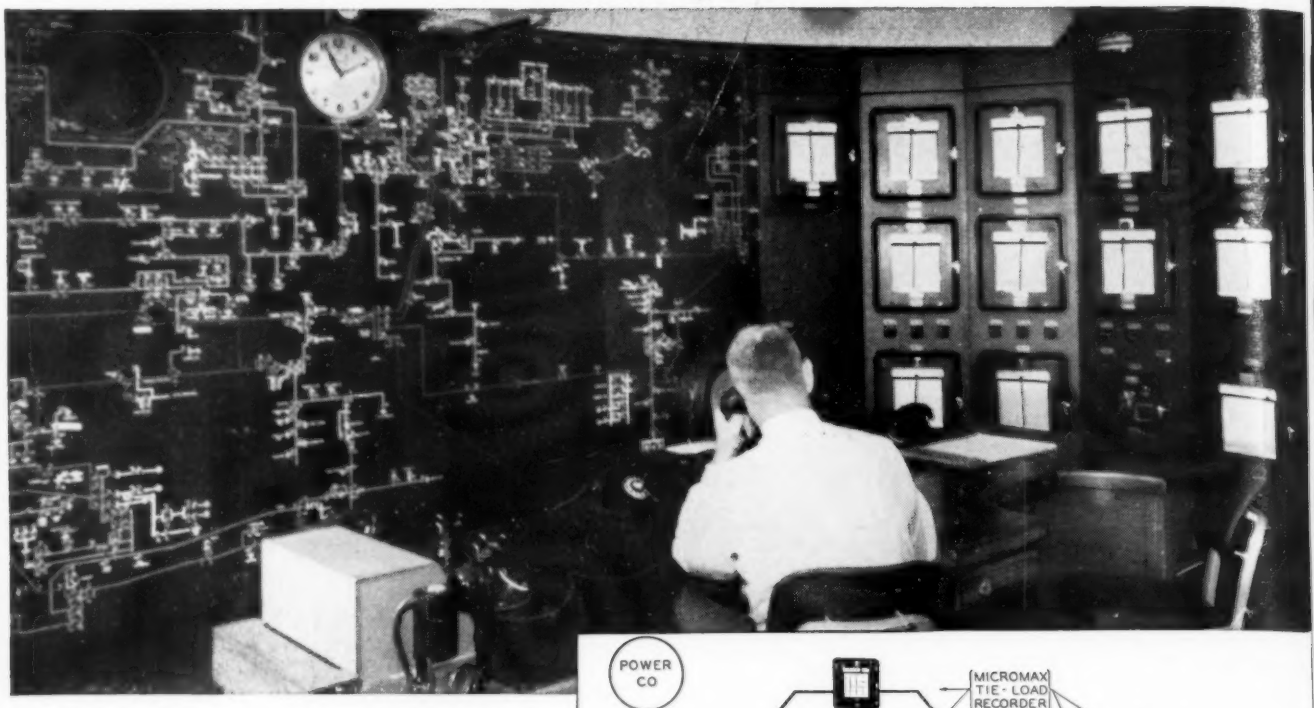
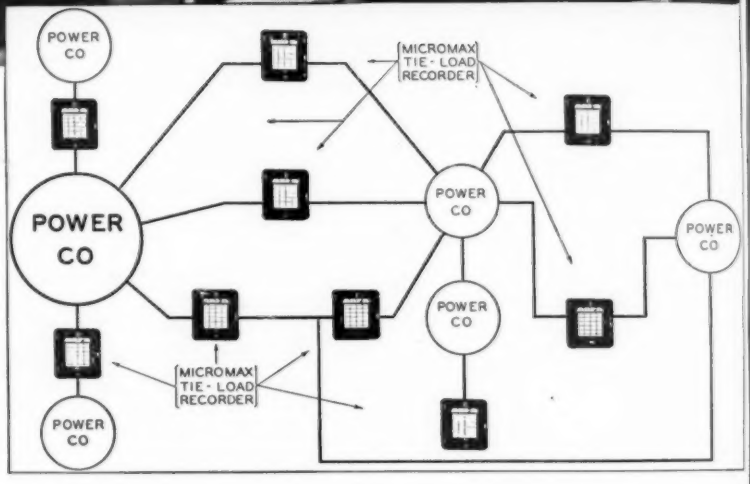
POWER

MARCH
1948

A McGRAW-HILL PUBLICATION DEVOTED TO GENERATION, TRANSMISSION AND APPLICATION OF ALL THE POWER SERVICES

IN THIS ISSUE: A proposal for standardizing industrial turbines to reduce cost and speed delivery, p 73; design analysis of Philadelphia's new Southwark Station, p 64; how a refinery solved the problem of 100% make-up at 1350 psi, 900 F, by advanced water treatment and installation of dual-circulation boiler, p 84 TABLE OF CONTENTS, p 59





Above: System operating room showing portion of a system map and 12 Micromax Load Recorders. At Right: Block diagram showing interconnections and 9 Micromax instruments which show tie-line load. The instruments shown in the photograph but omitted in the diagram are for tie-line bias, net interchange, and net system load.

Economic Distribution Of System Load

IS SPEEDED BY L&N TELEMETERING AND CONTROL

Tie lines radiate in various directions to the north, south and east from one of the country's big power systems, joining them to their power-company "neighbors". This pool of generating capacity carries a heavy interstate electric load, and the Company has found that L&N load telemetering and load-frequency control equipment is a "very definite help" in meeting the complex needs of system operation. The instruments help in two ways:

1. Operators can see continuously the load at any metered point. Because they can read either instantaneous load or load trends for some hours past, they can make on-the-spot decisions with speed and accuracy, and their instructions are carried out automatically.

2. Executives can examine, at their convenience, the load records for any period of time, and can base broad operating and policy decisions on a fuller knowledge of the size, shape and peculiarities of system conditions.

Over ninety per cent of all interconnected capacity in the entire country uses L&N load-frequency equipment. Whether your facilities are interconnected or isolated; whether they need telemetering or just flat frequency control, there's an L&N equipment to suit your local conditions and handle all engineering and operating situations. We will send facts on request—you'll possibly need them in the future, if not now. Leeds & Northrup Co., 4910 Stenton Ave., Philadelphia 44, Pa.

MEASURING INSTRUMENTS · TELEMETERS · AUTOMATIC CONTROLS · HEAT-TREATING FURNACES

LEEDS & NORTHRUP CO.

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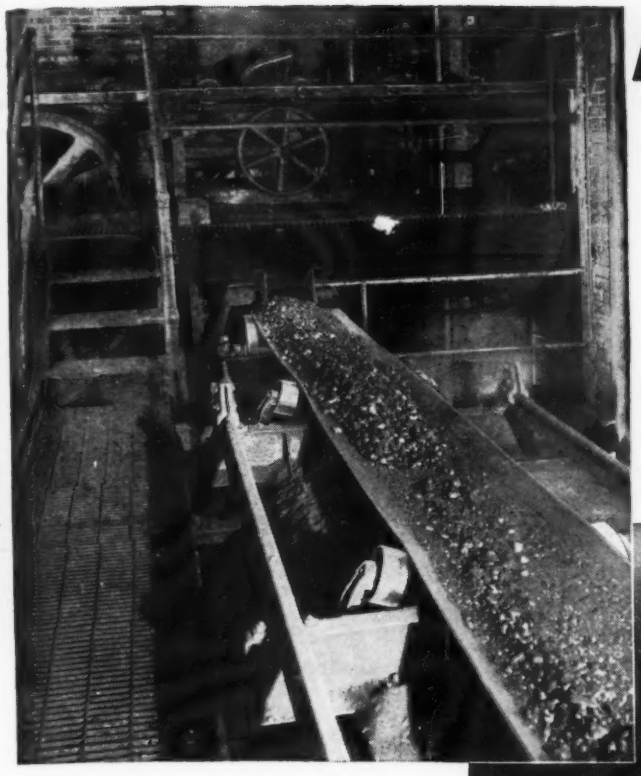

FLEXIBILITY and EFFICIENCY IN COAL HANDLING

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DETROIT

← At top of boiler house, Peck Carrier discharges to L-B belt conveyor, which distributes coal in main bunker by means of self propelled tripper.

Good Planning with Good Equipment Pays Off at The Rath Packing Co.

• Fifty tons of coal per hour can be unloaded from railroad cars, crushed to size, then elevated and distributed throughout the length of the main bunker by the two Link-Belt belt conveyors and Peck Carrier shown in these views. Satisfactory performance of this equipment results not alone from its advanced design and quality construction but also from the experience and careful planning that determined its selection and layout.

Link-Belt Company can supply from its broad line, every type of conveyor, elevator, feeder and power transmission machinery, together with unbiased counsel based on the broadest experience with every type of industry.

↑ Drive of Peck Carrier includes L-B Herringbone gear speed reducer and L-B Silverstreak silent chain drive. This carrier receives coal as discharged from crusher in basement of plant and elevates it to top of boiler house. See upper left hand illustration.

↑ Below track hopper, reciprocating feeder and belt conveyor to carry coal to crusher.

•

LINK-BELT COMPANY
Chicago 9, Indianapolis 6,
Philadelphia 40, Atlanta, Dallas 1,
Minneapolis 5, San Francisco 24,
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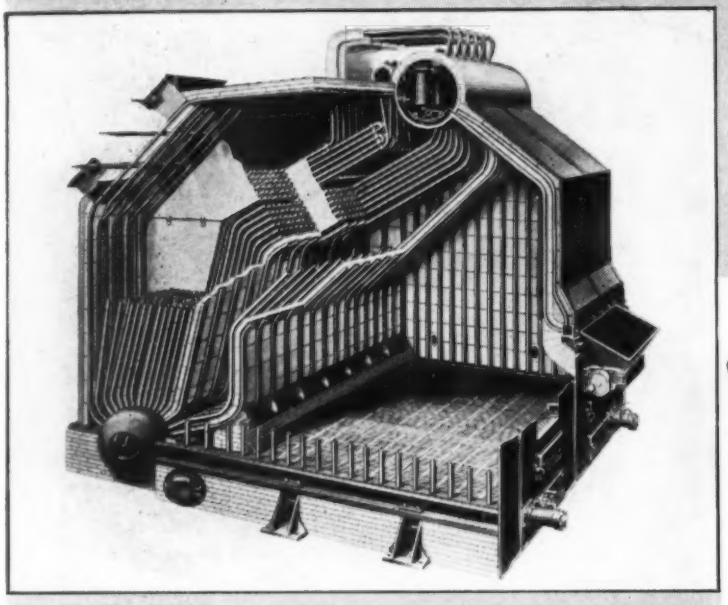
THE SYMBOL OF QUALITY · LINK-BELT COMPANY · L-B
COAL AND ASHES HANDLING EQUIPMENT



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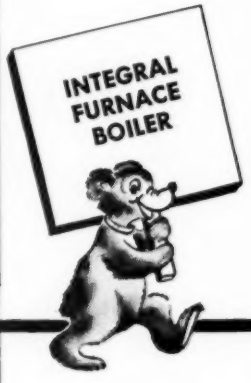
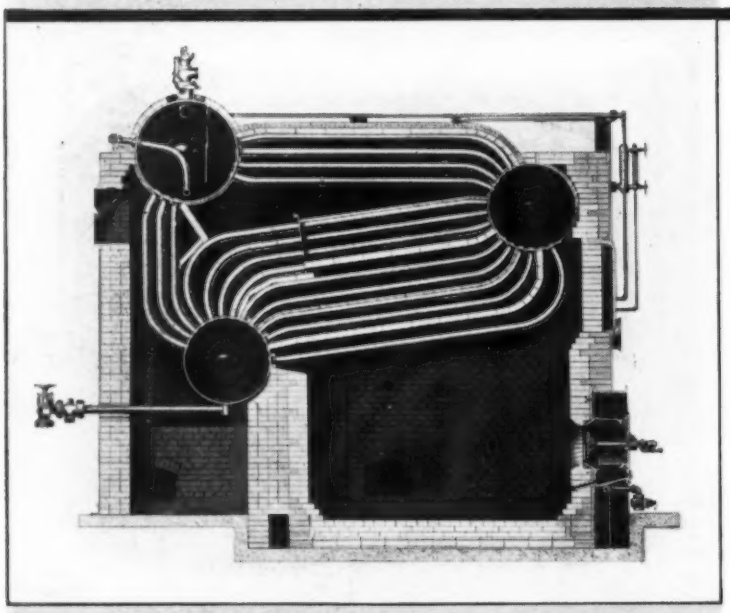
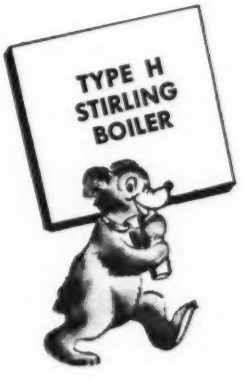
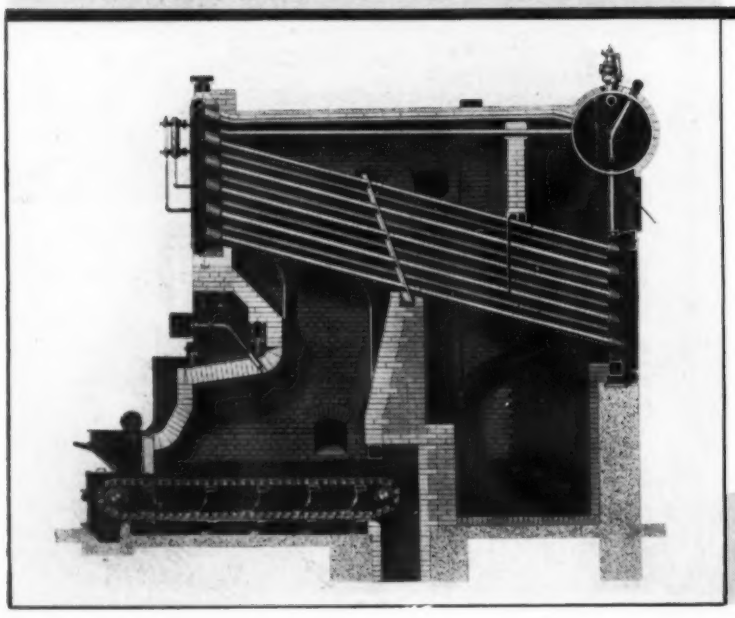


B&W Integral-Furnace Boiler, Type FF, with completely water-cooled furnace, for high-duty power and process services.



Type H Stirling Boiler usually for low headroom installations where all-refractory furnaces are suitable—water cooling may be added.





B&W Design 32 Boiler for low headroom installations where simplicity of straight-tube type is desirable.

B&W CUBS*

...three SMALL boilers with three BIG benefits

In B&W Design 32, Type H Stirling, and Type FF Integral-Furnace Boilers, B&W offers a selection of *three* different units designed expressly for steam requirements from 10,000 to 60,000 lb. per hr. at pressures above 160 psi. Each has distinctive features that make it the best buy in boilers for specific service conditions, yet ALL three are outstanding for their compactness—maximum steaming capacity in minimum space; and for complete coordination of components into highly efficient units of simplified design and standardized construction.

Their high standards of performance, continuity of service, and long-term economy have won wide acceptance for these boilers for many years. In 1947, for example, orders placed for B&W CUBS* represented an aggregate steam capacity of over 2,900,000 lb. per hr.

ALL COMPACT

ALL COORDINATED

ALL COMPLETE

* Complete Unit BoilerS
Each as much a package boiler as any unit its capacity can be.

G-387 T

FOR POWER PLANTS — B&W, Open-Pass, Radiant, Integral-Furnace, Cross-Drum, Stirling and Waste-Heat Stationary Boilers . . . Air Heaters . . . Economizers . . . Superheaters . . . Water-Cooled Furnaces . . . Oil, Gas & Multifuel Burners . . . Chain-Grate Stokers . . . Stacks and Breechings . . . Seamless & Welded Tubes for All Pressure and Mechanical Applications . . . Refractories . . . Chemical Recovery Units . . . Alloy Castings.

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OTHER B&W PRODUCTS — Marine Boilers . . . Pressure Vessels . . . Process Equipment

BABCOCK & WILCOX

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GENERAL OFFICES: 85 LIBERTY ST., NEW YORK 6, N.Y.
WORKS: ALLIANCE AND BARBERTON, O.; AUGUSTA, GA.

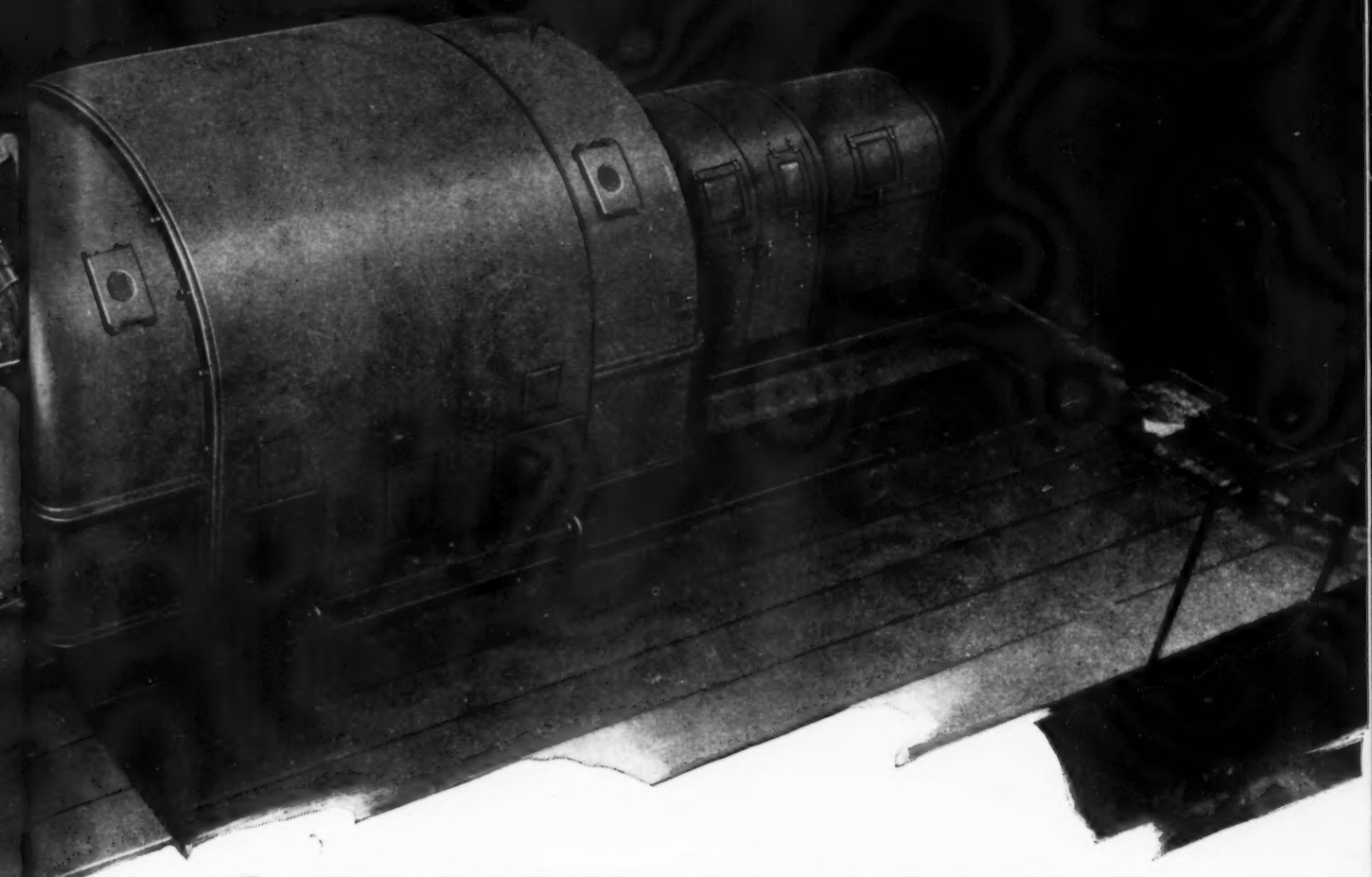
Dress r

THIS 11,500-KW TURBINE-GENERATOR UNIT

is going through its paces on the Elliott test floor before shipment to an important southern utility plant for outdoor installation. It is one of a number of similar Elliott units, several of larger capacity. The turbine (which will later be heat-insulated and streamline-jacketed) operates on 600-psi, 825 F steam and has four uncontrolled extraction points for feedwater heating.

Elliott

rehearsal for 11,500 kw



HOW'S SHE DOIN'? Emergency overspeed governor and speed governor in correct adjustment? Bearing temperatures right? Vibration below acceptable limits? Lubrication system functioning perfectly? All those questions and many more like them must be answered before this new Elliott turbine-generator is dismantled, given its final inspection, and shipped. The test floor is the final arbiter on all the careful calculating, split hair machining, meticulous generator winding, and the thousands of other processes which precede the assembling of a good-sized turbine-generator whose dependability is a **must.** The proof is in the instrument readings.

Elliott turbine-generators, built from turbine-inlet to generator terminals in the Elliott shops, are tested as carefully as they are designed and constructed.

H-715

COMPANY
Steam Turbine Department
JEANNETTE, PA.
Plants at: JEANNETTE, PA. • RIDGWAY, PA.
SPRINGFIELD, O. • NEWARK, N. J.
DISTRICT OFFICES IN PRINCIPAL CITIES

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FEEDWATER HEATERS AND DEAERATORS • STEAM JET EJECTORS
CENTRIFUGAL BLOWERS • TURBOCHARGERS FOR DIESEL ENGINES
TUBE CLEANERS • STRAINERS • DESUPERHEATERS • FILTERS

ANNOUNCING A 2
CAPACITY RATINGS

Makes possible the use of smaller bearings—
with savings in bearing cost, material cost and weight
—and more compact product design

IN the ten years since the present load capacity ratings of Timken tapered roller bearings were established, Timken bearings have been steadily improved. Improved so much that today the load carrying capacity of Timken bearings is a good *25% greater* than it was 10 years ago!

As a result, The Timken Roller Bearing Company is now able to announce a 25% increase in the load capacity ratings of all Timken bearings —following a careful review of laboratory studies on fatigue life machines over the past ten years, together with close observation of bearing performance in the field.

Permits Use of Smaller Bearings

Now you can safely carry your present bearing loads on smaller size Timken bearings. Reductions in size of shafts and housings are possible. Products can be made more compact—lighter in weight. You have an opportunity to save both on bearing costs and material costs. And this increase in ratings should enable engineers to utilize the advantages of Timken bearings in an even broader variety of applications than has been practicable in the past.

Result of Constant Quality Improvement

This 25% increase in Timken bearing capacity ratings is based on continued improvement in the quality of Timken tapered roller bearings over the past 10 years. It is due to a number of factors, including improved alloy steels made in our own Timken steel mill specifically for anti-friction bearings, better metallurgical control in the processing of this steel, more accurate manufacturing equipment, greatly improved surface finishes, and more accurate inspection methods. That these improvements in Timken bearing quality have resulted in 25% greater load capacity has been conclusively demonstrated by years of exhaustive laboratory and field studies!

New Engineering Journal to Give Facts

A new Timken Engineering Journal is now in

25% INCREASE IN OF TIMKEN® BEARINGS

The result of years of constant improvement in Timken bearing quality—supported by exhaustive laboratory studies and extensive field experience

preparation which will give complete capacity rating tabulations and will also include new bearings introduced since the last publication. Pending publication of the new Journal you may take full advantage of the 25% capacity increase by multiplying the existing ratings by 1.25.

For further assistance in the application of Timken bearings, call upon our field engineers or our Engineering Department.

Timken tapered roller bearings take any combination of radial and thrust loads, hold shafts in rigid alignment, assure precision and minimize friction. The 25% increase in load capacity ratings is the *latest* example of Timken leadership in serving the bearing needs of all industry . . . one more reason why it pays to look for the trade-mark "Timken" on every bearing you use. The Timken Roller Bearing Company, Canton 6, Ohio. Cable address: "TIMROSCO".

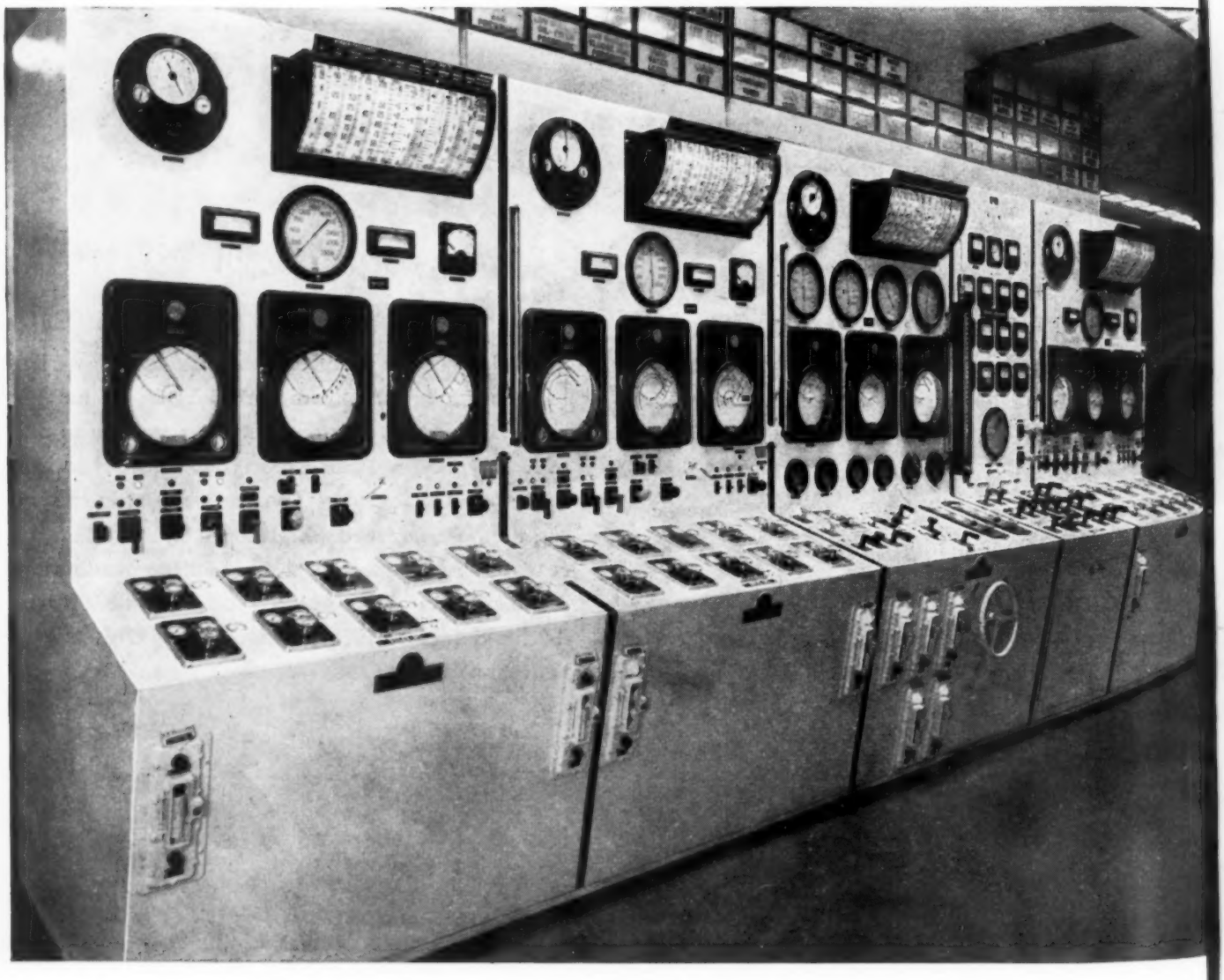
TIMKEN

TRADE-MARK REG. U. S. PAT. OFF.

TAPERED ROLLER BEARINGS

NOT JUST A BALL NOT JUST A ROLLER THE TIMKEN TAPERED ROLLER BEARING TAKES RADIAL AND THRUST LOADS OR ANY COMBINATION

put your Btu's



Bailey Boiler Panel for a co-ordinated system of Combustion, Feed Water and Steam Temperature Control on three 1500 psi, 950 F, 200,000 lb. per hour gas and oil-fired boilers.

Branches in: Boston, New York, Schenectady, Philadelphia, Buffalo, Pittsburgh, Cleveland, Detroit, Cincinnati, Atlanta;

in shirtsleeves

You can't have low power costs unless the Btu's you feed your boiler roll up their sleeves and go to work. They all won't anyway. The job to do is to put as many to work as possible. Then you get low power costs. And that is exactly what the Bailey co-ordinated boiler control system is designed to do.

This system reduces fuel consumption per pound of steam generated. Combustion, feed water, steam temperature, heater levels, pump speeds and all other factors are co-ordinated. Safety of operation is increased—continuity of service is improved.

You put the maximum number of Btu's to work in power and get all the efficiency your boiler was designed to deliver.

But remember this. The Bailey system is not delivered as a standard package. Each one is designed and engineered to the specific job on which it is to be used. That's why it functions so efficiently.

If you are looking for low cost power, it will pay you to call our nearest office.

BAILEY METER COMPANY
1036 IVANHOE ROAD • CLEVELAND 10, OHIO
BAILEY METER COMPANY LIMITED, MONTREAL

BAILEY METERS

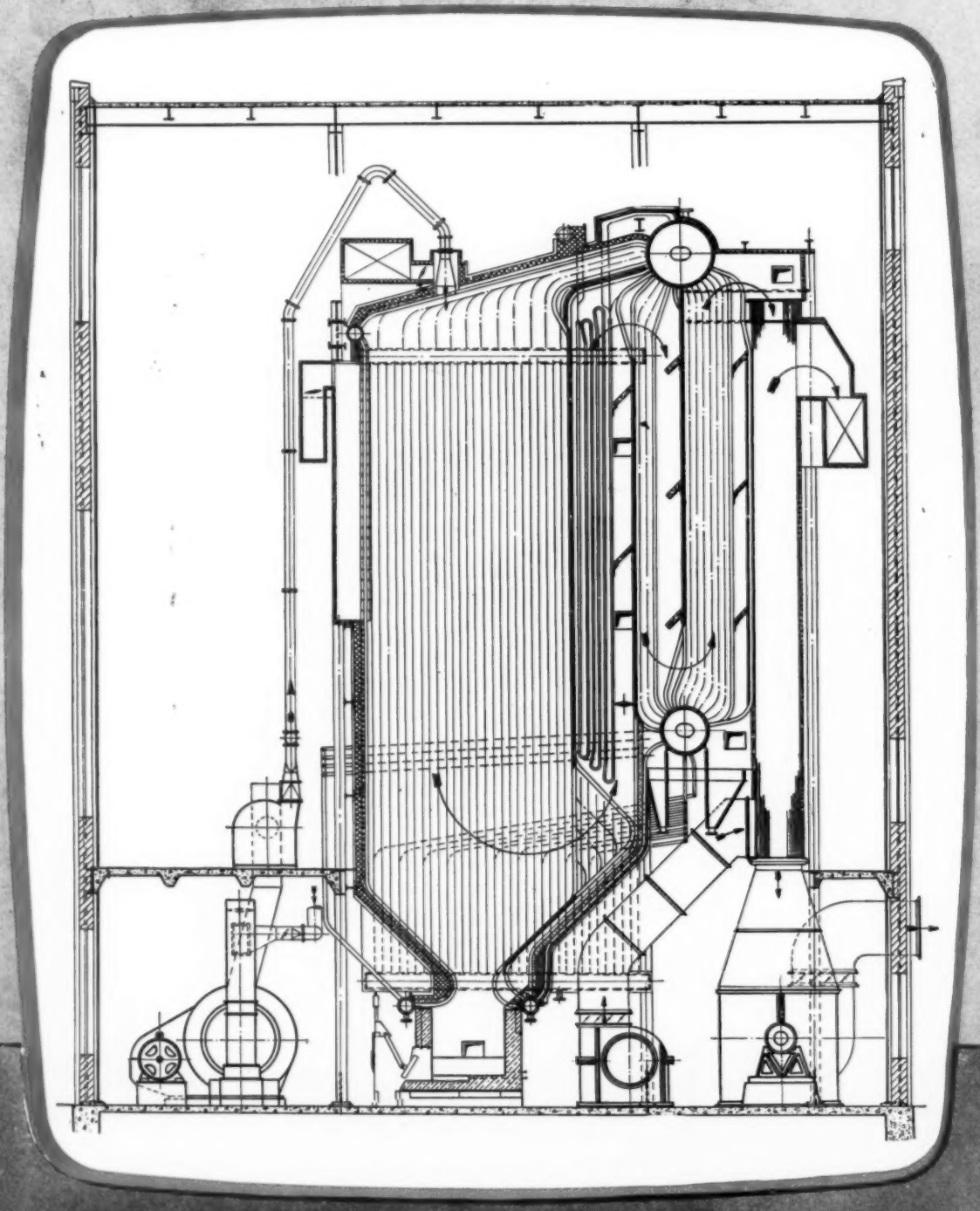
Controls for Steam Plants

COMBUSTION • FEED WATER • TEMPERATURE
PRESSURE • LIQUID LEVEL • FEED PUMPS

A-103-2

Chicago, Milwaukee, St. Louis, New Orleans, St. Paul, Kansas City, Houston, Denver, Los Angeles, Seattle, San Francisco

KVS ENGINEERING



# of COAL BURNERS

Provides

high furnace temperature combustion on all grades of fuel

The Kennedy Coal Burner embodies all desirable features . . . low first cost, low maintenance, and high availability. It is particularly suited to the burning of anthracite coal.

KVS has engineered the following advantages into its burners:

—high turbulence, completing the carburization of the coal . . .

—with top firing, positive furnace pressure maintains an extremely high temperature, and anthracite coal is readily burned without the usual refractory-covered tube area necessary with other types of burners and firing . . .

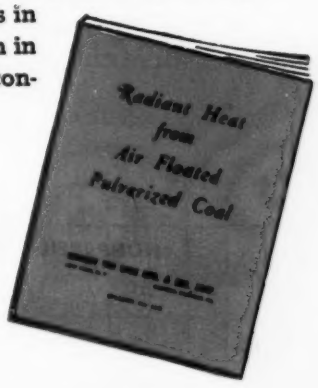
Combustion is completed in a relatively short distance from the burner, producing high-temperature luminous gases to radiate on the furnace walls, resulting in high evaporation in the furnace area . . .

—all carbon particles are completely burned, and when gases turn at the bottom of the furnace to enter the superheater area, the ash, (which is the residue) is dropped into the ash hopper . . .

—the carbon loss is controlled by (1) fineness of pulverization, (2) turbulence at burner and (3) length of flame.

We have not featured KVS Air Swept Tube Mills with automatic controls here, because we believe the industry recognizes their superiority.

All other components of KVS Steam Generating Units are engineered to meet specific operating conditions on available fuels in order to assure the maximum in operating efficiency and economy at all boiler ratings.



KVS ENGINEERING SERVICE

KVS Steam Generating Equipment has been performance-proved over the years. KVS offers a complete service in design, building and erecting complete plants under one responsibility. KVS engineers are available for consultation on your requirements.

Ask for a copy of 97-page Engineering Bulletin No. 44-B containing valuable information on preparation of pulverized fuel and steam generating plants.

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2 PARK AVENUE • NEW YORK 16, N. Y.

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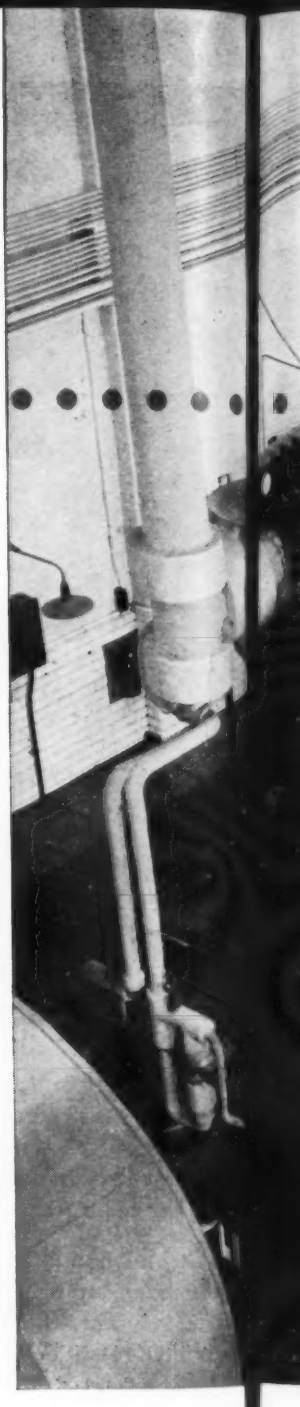
How's this for low-acidity operation?



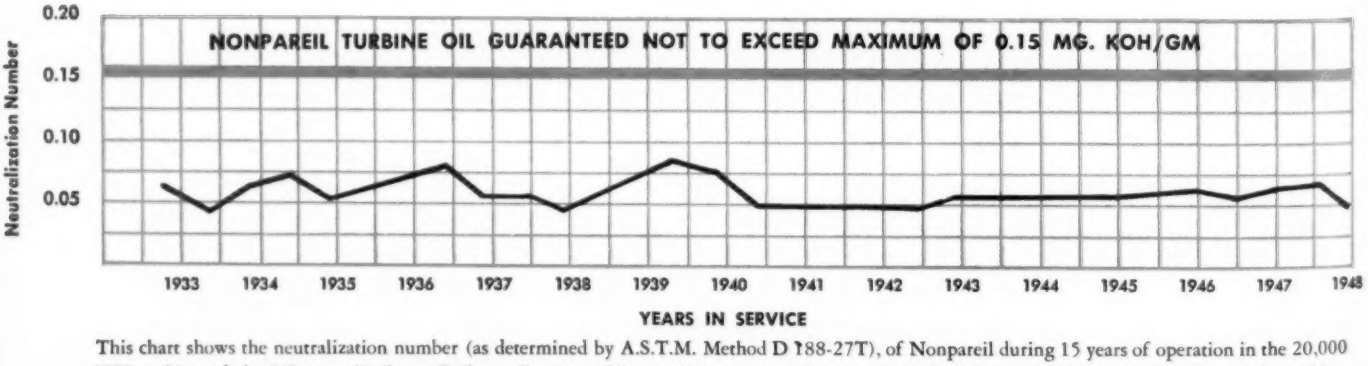
Illustrated (foreground) is the 20,000 KW turbine of the Minneapolis Street Railway Company. Also shown below is the 15-year acidity record of its lubricating oil—Nonpareil.

As you can readily see, the high point in the oil's acidity has been the extremely low neutralization number of .075 mg KOH/gm.

As a result of this low-acidity operation, there has been no oil treating, no turbine cleaning, and no oil replacement except the usual make-up oils. As another result, in 1946, when the company installed a new 15,000 KW turbine (also illustrated), the lubrication job was awarded to Nonpareil.

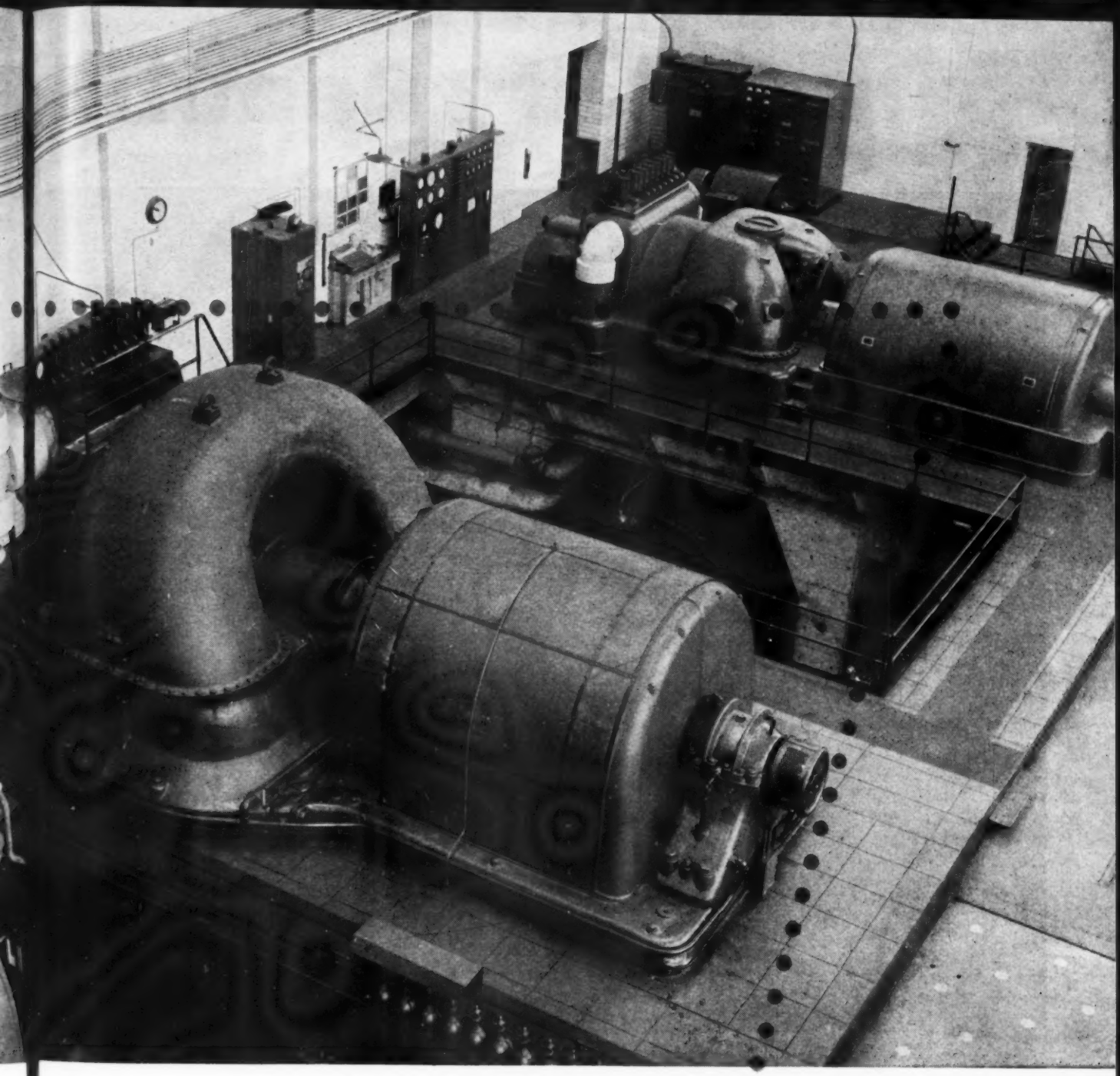
Why not assure trouble-free operation for your turbines with this different turbine oil—the only lubricant in its field that carries a written guarantee against excessive acidity.

Let a Standard Oil Lubrication Engineer explain how guaranteed Nonpareil can save you money. Write Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois.



This chart shows the neutralization number (as determined by A.S.T.M. Method D 188-27T), of Nonpareil during 15 years of operation in the 20,000 KW turbine of the Minneapolis Street Railway Company. Nonpareil is guaranteed not to exceed 0.15 mg KOH/gm for the life of the turbine.

STANDARD OIL COMPANY (INDIANA



NONPAREIL
TURBINE OIL

STANDARD OIL COMPANY (INDIANA)

STANDARD

Specify Republi

A Republic combustion control system operates the three boilers in this new power plant which supplies all the steam and power for a large university. During the first year of operation this new plant provided heat for 1 percent more building space, generated 114.3 perc more electric power but consumed 9.86 percent less fu

REPUBLIC
INSTRUMENTS
AND CONTROLS

Combustion Control

TO INCREASE TODAY'S STEAM PRODUCTION

TO DECREASE TOMORROW'S STEAM COST

The installation of Republic automatic controls on your boiler (or boilers) will enable you to:—

SAVE FUEL by automatically maintaining highest combustion efficiency.

INCREASE STEAM OUTPUT by operating the boilers at test efficiency 24 hr. a day, 7 days a week.

CONSERVE MANPOWER by automatically performing the many routine repetitive adjustments.

REDUCE OUTAGES by maintaining uniform operating conditions and thereby prevent the chain-of-event type of trouble that frequently developes as a result of incorrect boiler operation.

An automatic combustion control system, as designed and built by Republic, will help you meet today's need for more steam and tomorrow's need for lower steam costs.

The Republic combustion control is a unified system controlling simultaneously, in measured quantities and in correct proportions, the fuel and air input to the boiler. It increases or decreases the fuel and air supply to the boiler in the correct amount to maintain constant steam pressure and in the correct ratio to maintain maximum combustion efficiency. It not only checks operation but automatically makes necessary corrections of individual factors before faulty operation has a chance to develop.

The difference between such a control and an assembly of uncoordinated regulating devices is comparatively small in equipment but great in principle. Merely to provide automatic operation of a number of individual device is not enough.

CHECK THESE FEATURES

Built into the Republic combustion control systems are many features that enable it to fulfill all the conditions of theoretically perfect combustion control and still meet all the demands of everyday operation.

Check the following features against your list of "musts" for a perfect combustion control system.

CENTRALIZED CONTROL: The operation and control of the boiler or boilers is centralized at the master controller.

FUEL-AIR RATIO INDICATOR: The master controller is provided with mercury manometers which indicate the measured fuel and air inputs to the boiler and the fuel-air ratio.

FUEL-AIR RATIO ADJUSTMENT: A handwheel on the front of the master control panel provides a convenient means for adjusting the fuel-air ratio.

ALL BOILER RATINGS: Maintains proper fuel-air ratio over the entire range of boiler ratings.

CONSTANT STEAM PRESSURE: Maintains the plant steam pressure within narrow limits of variation by proportioning the fuel and air inputs to the load.

LOAD DISTRIBUTION: Provides a means of distributing the load among the boilers as desired.

MANUAL CONTROL: Boiler ratings can be controlled manually by a handwheel located on the front of the panel.

Find out about Republic control systems. One of our engineers will be glad to consult with you at any time. Write us today.

Republic Flow Meters Co.

2240 Diversey Parkway • Chicago 47, Illinois

NORTH

WEST EAST

SOUTH

it's YARWAY

From every corner of the country comes the same story—four out of every five high pressure boiler plants are equipped with Yarway Unit Tandem Blow-Off Valves.

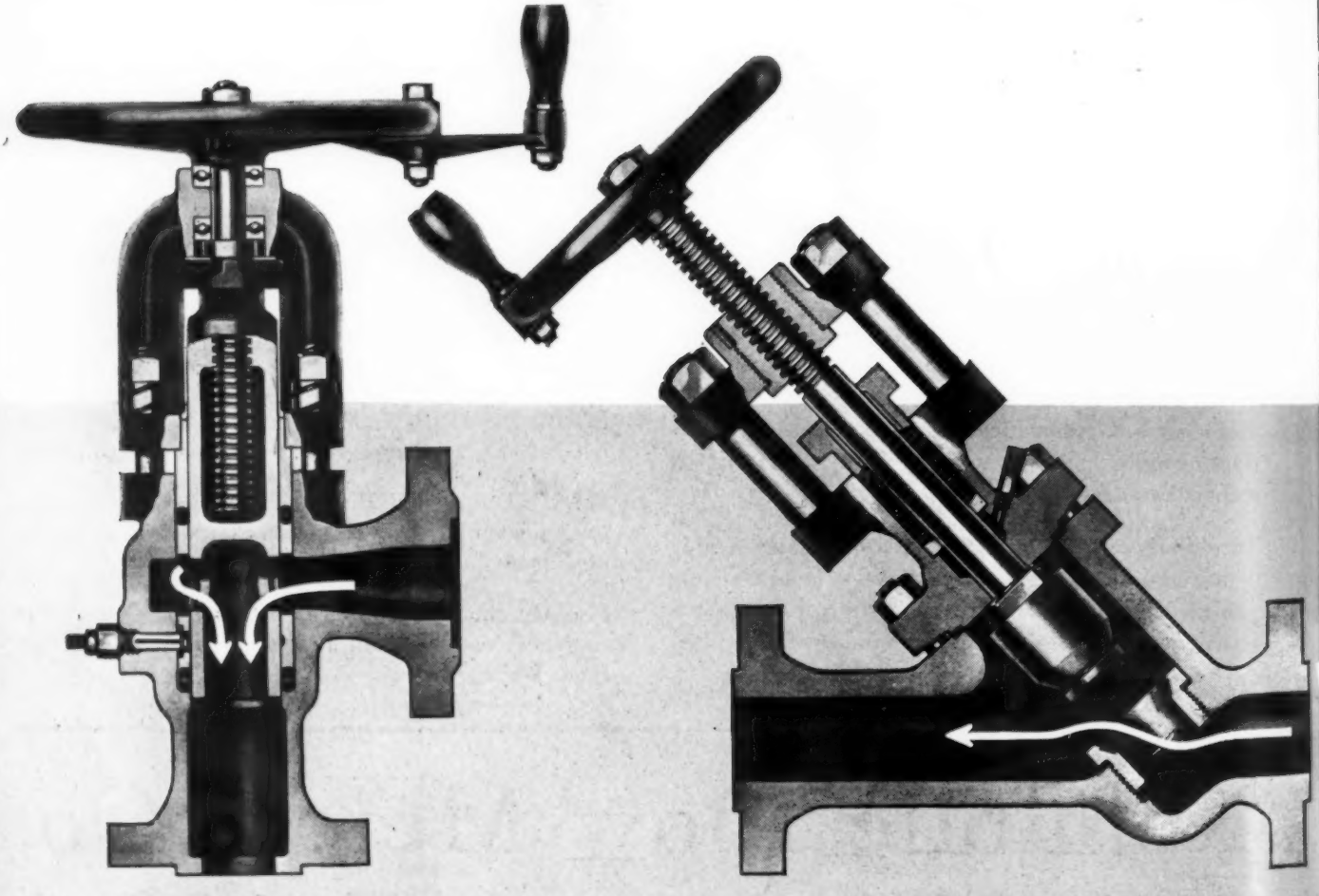
Each day's orders add to the evidence. From Ohio . . . 17 new Yarways, making a total of 746 purchased by this large utility over the last 35 years. From California . . . 10 new Yarway Unit Tandems for one company, 9 for another. Texas sends an order of 5 . . . 3 for one new municipal plant, 2 for another. Northern New York wants 7 for new boilers in a well-known utility. And so it goes.

Why this overwhelming preference?

Proved dependable performance, due to outstanding design, sound engineering and careful manufacture . . . plus constant research, leading to mechanical and metallurgical advancements that keep Yarway Valves ahead of changing service requirements.

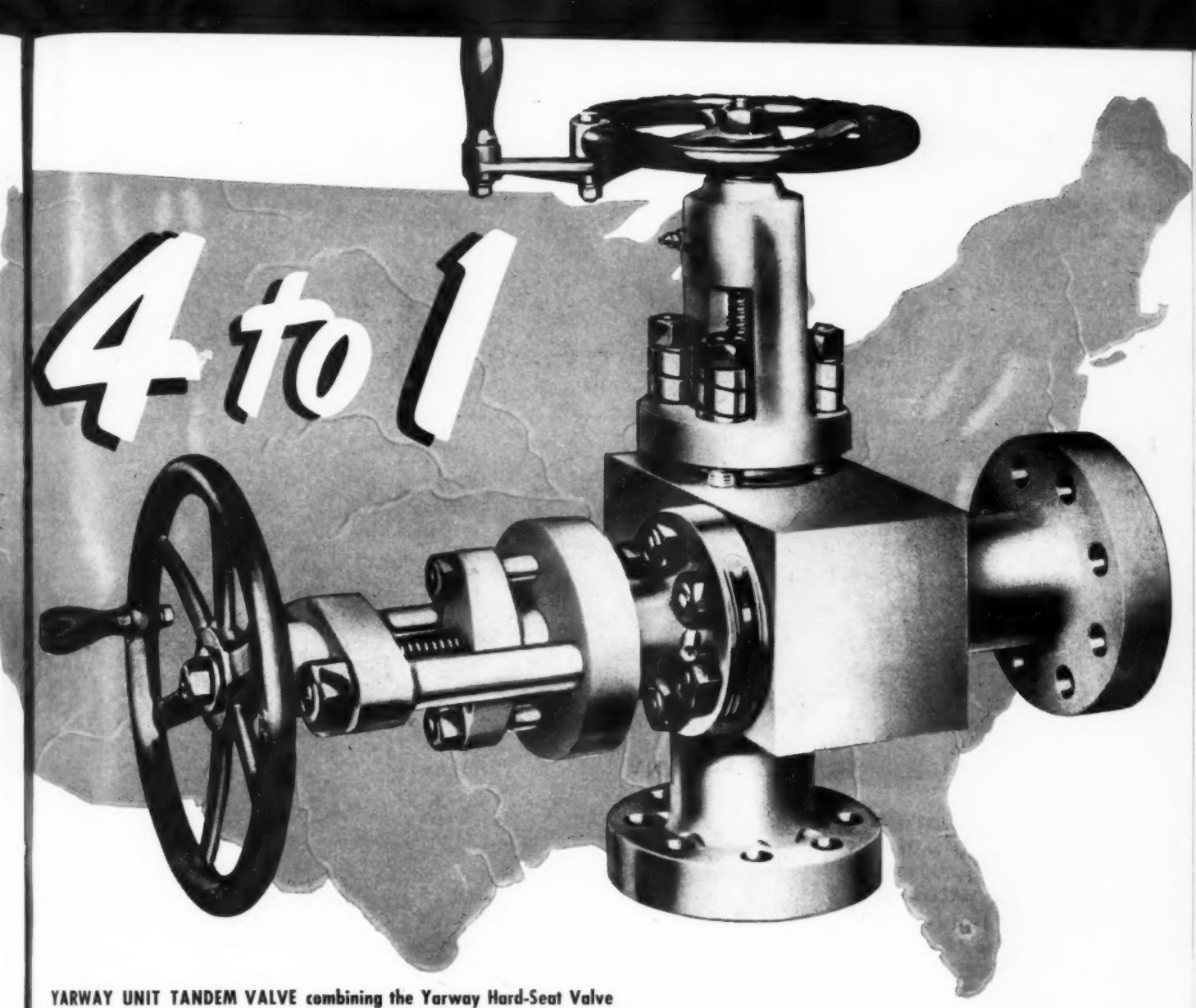
For latest information on Yarway Unit Tandem Blow-Off Valves, write for Yarway Bulletin B-432.

YARNALL-WARING COMPANY 100 Mermaid Ave., Philadelphia 18, Pa.



YARWAY TYPE "C" SEATLESS ANGLE VALVE
Open position. Notice balanced sliding plunger design. For pressures from 400 to 2500 psi.

YARWAY HARD-SEAT STRAIGHTWAY VALVE
Open position. A worthy companion to the Yarway Seatless Valve for tandem use on higher pressures. For pressures from 400 to 2500 psi.



YARWAY UNIT TANDEM VALVE combining the Yarway Hard-Seat Valve (for blowing) and the Yarway Seatless Valve (for sealing) in a single forged steel body. Flanged-type shown. For pressures from 400 to 2500 psi.

A FEW OF MANY PROMINENT PLANTS EQUIPPED WITH YARWAY BLOW-OFF VALVES

Cleveland Electric Illuminating Company
Avon, Ohio

Philadelphia Electric Company
Southwark Station
Philadelphia, Penna.

Pacific Gas & Electric Company
Kern Station
Bakersfield, California

Duke Power Company
Spencer, North Carolina

Lynn Gas & Electric Company
Lynn, Massachusetts

Phelps Dodge Corporation
Ajo, Arizona

Bethlehem Steel Company
Sparrows Point, Maryland

Tennessee Eastman Corporation
Kingsport, Tennessee

Ohio Oil Company
Robinson, Illinois

Solvay Process Company
Hopewell, Virginia

Fibreboard Products Company
East Antioch, California

Gulf States Paper Company
Tuscaloosa, Alabama

YARWAY BLOW-OFF VALVES

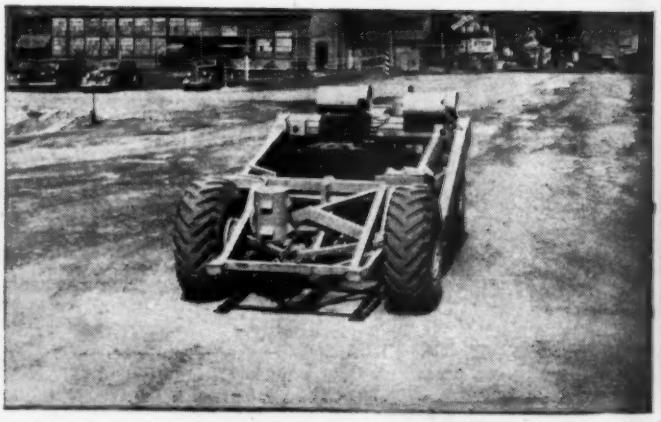
Stockpile your coal t

It pays to be prepared

To guard against costly interruptions in production and service, farsighted companies are building coal stockpiles 90 to 120 days ahead of regular needs . . . using the modern Tournapull method to speed handling and cut costs.

Picks up own load

Small size Tournapulls are self-loading . . . larger units require pusher assistance for maximum loads. Each unit is self-powered, individually operated by one man. Too, you can easily load Tournapulls direct from railroad cars by clamshell or overhead chute.



Hauls anywhere at high speed

Tournapulls travel over pavement or cross country at speeds up to 23 m.p.h. Tournapull method eliminates the requirement for overhead bridges and belt conveyors . . . does away with having to move heavy steel structures. Units are mobile . . . can put your coal stockpile anywhere.

LET

See your Le Tourneau Distributor NOW for complete information

l this faster, safer way

TOURNAPULL METHOD

speeds handling...saves storage space...

prevents combustion fires...

NOW, with the new high-speed Tournapull developed by LeTourneau Corporation, you can build up your coal stockpile in a hurry . . . pile more coal into smaller space . . . pack it down thoroughly to reduce internal combustion and provide better drainage.

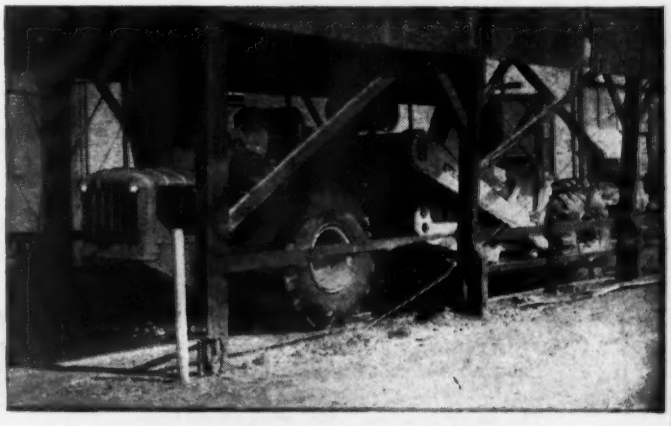
Using the Tournapull method, you can move from 2 to 16 tons of coal per trip, depending on Tournapull size . . . haul anywhere at average truck speeds . . . spread each load in smooth, uniform layers . . . compact coal without damage, through cushioning action of big, low-pressure tires.

Tournapulls also profitably handle ore, chemicals and other bulk materials to hoppers or conveyors.

For complete details on this modern, high-speed Tournapull method of handling materials get in touch with your nearest LeTourneau Distributor or write to: R. G. LeTOURNEAU, Inc., Peoria, Ill.

Compacts as it spreads

Tournapull spreads coal in 4" to 6" lifts. Big rubber tires and weight of unit give compaction while spreading or hauling . . . reduce danger of spontaneous combustion. Tournapull compaction also helps save storage space . . . minimizes infiltration of moisture.



Serves plant in emergency

During emergency stoppages, Tournapulls will load coal from stockpile . . . haul to plant . . . dump directly into bunker house grizzly or conveyors. Units also will haul over streets to service other company-owned plants in same city.

Tournapull—Trademark Reg. U.S. Pat. Off. CM

LETOURNEAU PEORIA, ILLINOIS HIGH-SPEED RUBBER-TIRED TOURNAPULLS

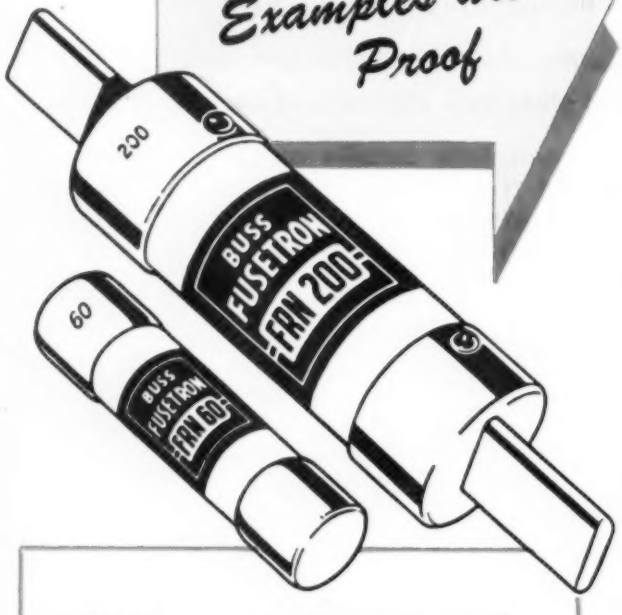
At Low Cost

FUSETRONS PROTECT

Coils, Solenoids, Transformers

AGAINST BURNOUTS

These Typical Examples are Proof



"In this institution we have 5 dumb waiters or elevators used for delivering meals to the various floors. They are driven by 5 h.p. motors. Prior to 1938, 10 ampere one-time fuses were used in the control circuit to protect the coils and 30 ampere fuses were used in the motor circuit. The 10 ampere fuses were too large to protect the coils properly, and they burned out frequently. Fuses in the motor circuit blew so frequently that it was necessary for a man to stand by three times a day at mealtimes ready to replace fuses as they blew.

"In the fall of 1938, when I became Chief Engineer of this hospital, one of the first things I did was to check over all panels, switches and fuses. In these elevator circuits I installed 6¼ ampere Fusetrons to protect the coils in place of 10 ampere one-time fuses, and 20 ampere Fusetrons in the motor circuit in place of 30 ampere one-time fuses. In August of 1945, I was able to report that since this was done in 1938, not one coil has burned out and it was no longer necessary to have a man stand by at mealtimes to replace fuses in the elevator motor circuit. That trouble has disappeared entirely."

Leland J. Mamer, Chief Engineer
Evanston, Ill.

"The transformers on our meter testing boards require protection by one ampere fuses. These fuses, however, were blown whenever a motor was cut in on the ascending cycle of the current wave due to current surge.

"In October 1945 we installed one ampere Fustats (Fusetrons with a tamper-resisting base). They reduced needless blows from about five per week to one per month and at the same time completely eliminated any danger of damage to the transformers in the circuit."

A. L. Pollard
General Superintendent of Operations
Puget Sound Power & Light Co.
Seattle, Washington

What is the Fusetron?

The Fusetron is a Dual Element device — a Fuse to which is added a Thermal cutout.

The result is a fuse with tremendous time-lag and much less electrical resistance.

Fusetrons have the same degree of Underwriters' Laboratories approval for both motor-running and circuit protection as the most expensive devices made.

Made to the same dimension as ordinary fuses, Fusetrons fit all standard fuse holders.

Obtainable in all sizes from 1/10 to 600 ampere in both 250 and 600 volt types. Also in tamper-resisting type (Fustats) for 125 volt circuits.

Their cost is surprisingly low.

BUSS

Eliminate Shutdowns Simply and Inexpensively

Fusetrons Can Save Costly and Troublesome Replacement Jobs

Why risk the loss of expensive coils, solenoids and transformers when you can protect them with Fusetrons? At a cost of just a few cents, a Fusetron, properly installed, will protect against costly burnouts.

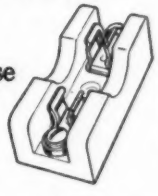
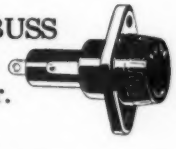
A transformer or coil can be protected because the long time-lag of the Fusetron permits it to hold all normal current surges and harmless overloads — yet it will open to prevent burnout on any dangerous overload.

A solenoid, likewise, can be protected because the Fusetron will not open on the operating surge but will open in time to protect should the heavy current continue too long for any reason.

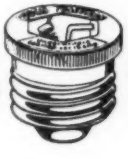
Burnouts mean costly and troublesome repair or replacement jobs. Why take a chance on crippling your operations?

Here's All You Need

TO PROTECT COILS, SOLENOIDS, TRANSFORMERS.

A Fusetron of proper size, plus a fuse block—  or a BUSS fuse-holder. 

On voltages up to 125, the same accurate, dependable protection can be provided with

a proper size plug Fusetron  or a Fustat, plus a fuse block.

Fusetrons Give Many Other Kinds of Protection Heretofore Not Available

Fusetrons do everthing fuses do, as is confirmed by Underwriters' Laboratories Label, and in addition . . .

- ★ Entirely wipe out needless blows caused by motor starting currents or other harmless overloads.
- ★ Give Thermal Protection to Panelboards and Switches.
- ★ Lesser resistance means cooler operation and prevents needless blows caused by heating in panels and switches.
- ★ Permit use of larger motor or adding more motors on circuit WITHOUT installing larger switch or panel.
- ★ On new installations, PROPER size switches and panels can be used instead of OVERSIZE.
- ★ Protect small motors against burnout, simply and inexpensively.
- ★ Give DOUBLE protection to large motors.
- ★ Provide simplest way to stop burnouts from single phasing.
- ★ Protect coils, transformers and solenoids against burnout.

Get All the Facts

Get Better Protection — Send the Coupon Now

Don't risk avoidable losses. One burned out solenoid — or one needless shutdown — or one destroyed panel — may cost you more than replacing every fuse with a Fusetron.

You simply protect your pocketbook by installing Fusetrons throughout the entire electrical system.

Fusetrons

Sold Through Wholesalers

Bussmann Mfg. Co., University at Jefferson
St. Louis 7, Mo. (Division McGraw Electric Co.)
Please send me complete facts about BUSS Fusetrons.

Name _____

Title _____

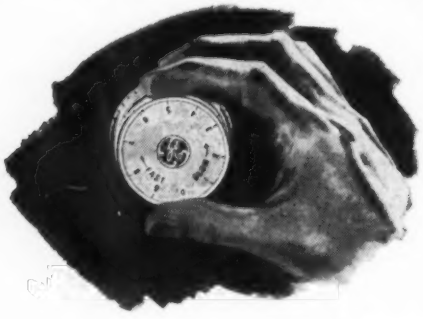
Company _____

Address _____

City _____ *State* _____

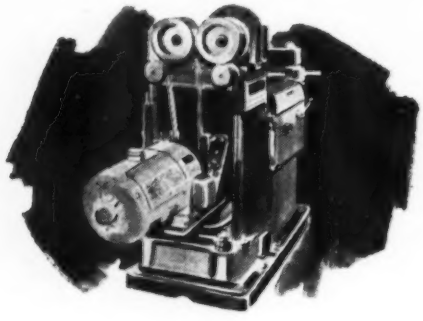
348

dial any speed . . .



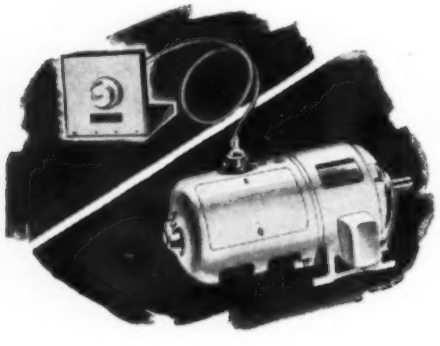
At the twist of a dial, the new Tri-Clad Type ACA induction motor will operate at any speed over a 3 to 1 range! What's more, it will do it while running on alternating current — without any converting equipment or mechanical devices whatsoever. It changes speed quickly and smoothly. In fact, wherever an adjustable-speed drive will improve quality or quantity of output, the Tri-Clad Type ACA induction motor may be a simple, economical solution.

for any machine . . .



The list of applications to your right is only a glimpse at the hundreds of potential uses where this new Tri-Clad adjustable-speed motor might well be considered. Its simplicity and ease of Installation make it an easy motor to fit to the job. Standardized NEMA dimensions are used so *there are no new mounting problems.* Its overall length is only slightly more than a constant-speed motor of comparable rating. And for the work it does, the Type ACA is one of the lightest motors in its field.

from any location!



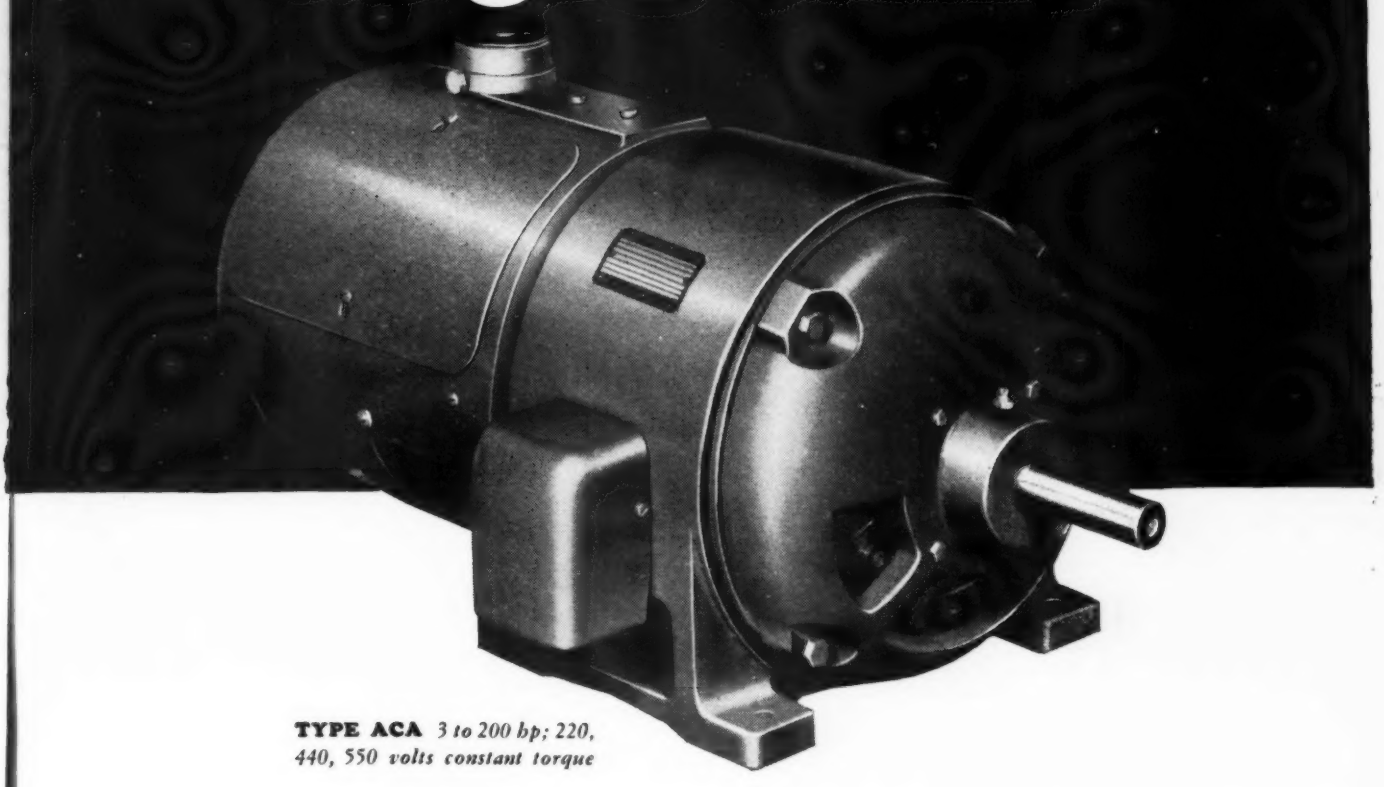
There are few limitations on your choice of location for this Tri-Clad motor, at the present offered in dripproof construction. Famous Tri-Clad construction gives it a sturdy frame for *extra protection* against physical damage; improved winding insulation for *extra protection* against electrical breakdown; and rigid bearing mountings with easy-to-lubricate bearings for *extra protection* against operating wear-and-tear. For remote control, a flexible cable or pilot motor is available. For more information, write today for Bulletin GEA-4883. *Apparatus Department, General Electric Company, Schenectady 5, N. Y.*

GENERAL ELECTRIC

THE NEW TRI-CLAD A-C MOTOR

REG. U.S. PAT. OFF.

with 3 to 1 speed range



TYPE ACA *3 to 200 hp; 220, 440, 550 volts constant torque*

HERE'S WHERE TO USE IT!

Textile
- Slashers
- Knitting machines
- Individual finishing machines
- Spinning frames
- Weaving machines
- Printing machines

Chemical
- Shakers
- Grinders
- Pulverizers
- Mixers
- Liquid pumps
- Solids pumps

Food
- Ovens, dryers
- Mixing machines
- Labeling machines
- Grinders
- Centrifugal machines
- Conveyors
- Shaker Screens
- Pumps

Printing
- Job presses
- Coating machines
- Trimming machines
- Stitching machines
- Rotary web presses

Paper
- Winding machines
- Slitters
- Supercalenders
- Coating machines
- Waxing machines
- Embossers
- Other converting machinery
- Stock preparation machinery
- Conveyors

Metal-working
- Drawbenches
- Lathes
- Stamping presses
- Milling machines
- Grinders

Mining
- Mill feeder drives
- Crusher feeder drives
- Sinter conveyors
- Other conveyors

GENERAL ELECTRIC COMPANY, Section D750-293
Apparatus Department, Schenectady 5, N. Y.

Please send me Bulletin GEA-4883 which describes the new Tri-Clad Type ACA motor:

NAME_____

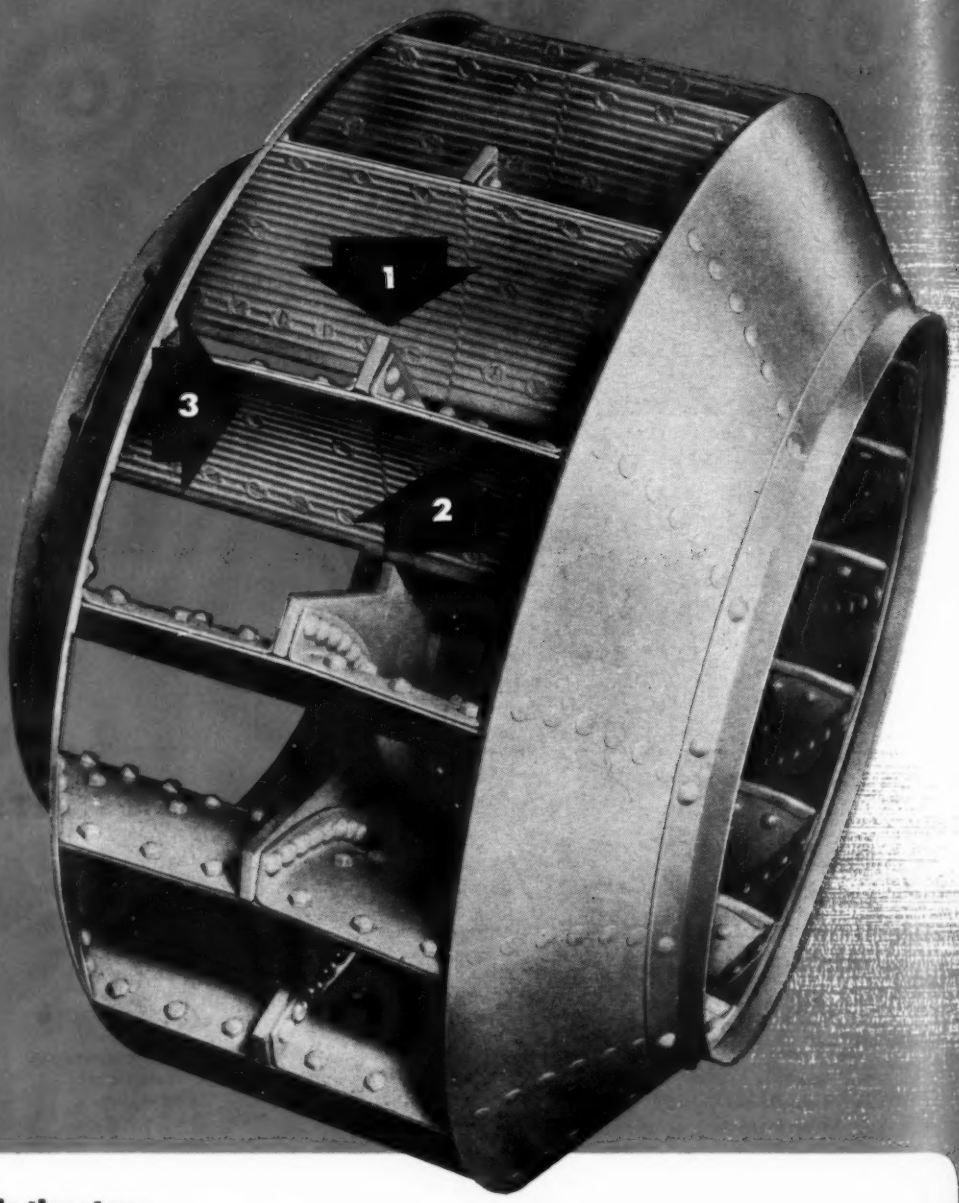
COMPANY_____

ADDRESS_____

CITY_____ STATE_____

You can't beat Tri-Clad Extra Protection!

THE E-R* WHEEL



This picture tells the story

1. Center support is cut away between the fan and the blades, permitting streams of concentrated fly-ash to meet—and dissipate their abrasive action on each other instead of on the wheel surfaces.

2. Continuous blades offer no obstruction to the smooth flow of fly-ash. Center plates and tie rods are eliminated. Each wheel has only 32 blades, shaped to minimize abrasive action.

3. Where fly-ash travel is greatest, special ribbed liners protect the wheel blades. These liners, easily and quickly renewable, prolong wheel life, save maintenance time and labor, and minimize outage losses.

IS THE REASON

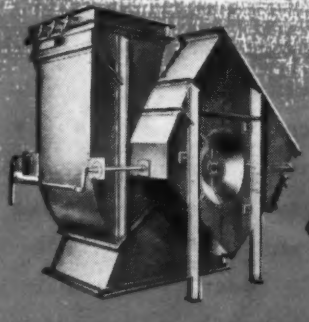
WHY STURTEVANT TVID FANS GIVE 2 TO 4 TIMES LONGER LIFE

It used to be that abrasion resistance of an induced draft fan wheel was unimportant. Low pressures and low tip speeds meant a low rate of wear. Today, because of higher tip speeds and higher pressures, abrasion resistance is as vital a factor in fan design as capacity or efficiency. Actually it is even more important to the operator who has to shut down his induced draft fan for a costly time-consuming job of reblading.

The E-R° (erosion resistant) wheel is the Westinghouse solution to this problem. Note in the illustration at the left how this design minimizes erosive action of the fly-ash; how it minimizes shut-down time because only the blade liners need be renewed. Results? Well, many years of service, in numerous installations, prove conclusively that it gives two to four times longer life, lower maintenance, and higher efficiency. For more information write: Westinghouse Electric Corporation, Sturtevant Division, 27 Readville Ave., Hyde Park, Boston 36, Mass.

Westinghouse

Sturtevant Division



This Book May Save You Money

Here's a booklet that contains a wealth of helpful information about mechanical draft equipment. Some of the data in it might very possibly be just what you need. For your copy, ask for Bulletin B-3801.

Sturtevant Turbovane Induced-Draft Fan

J-80049

Consider the figures

When you buy a combustion control system, only the first cost is in the bid—and you have to look *beyond* first cost to know which system is your "best buy."

Let's take the matter of depreciation, for example. Not depreciation as an arbitrary figure for the convenience of the accounting department, but as a measure of the useful and efficient life of the equipment. The ruggedly built components of the Hagan system last as long as the boiler—and longer.

How much will maintenance cost you? Surprisingly little—with Hagan. Simplicity of design is a major factor here, and Hagan equipment is designed to give minimum opportunity for wear, to use the fewest possible parts which may get out of order, to make maintenance easy. As one old-timer put it: "You don't have to be no watchmaker to work on Hagan controls."

that aren't in the bid——

All of these figures on costs, however, are far less important than figures on fuel. Take for example a 100,000 lb./hr. boiler, running 24 hours a day, 300 days a year. Coal consumption will be roughly 5 tons an hour. At $6.00 a ton, your fuel bill will be $720.00 a day, $216,000 a year. Such a boiler will consume a million dollars worth of fuel in less than five years—and five years is only a fraction of the useful life of boiler and control.

Figures like this make it clear that the really important thing is not the cost of the control system, but what that system will do to your fuel costs—and that brings you right back to Hagan.

Hagan equipment lasts as long as the boiler, stays accurate, and gives you dependable, trouble-free service as long as it lasts.

Our engineers are at your service.

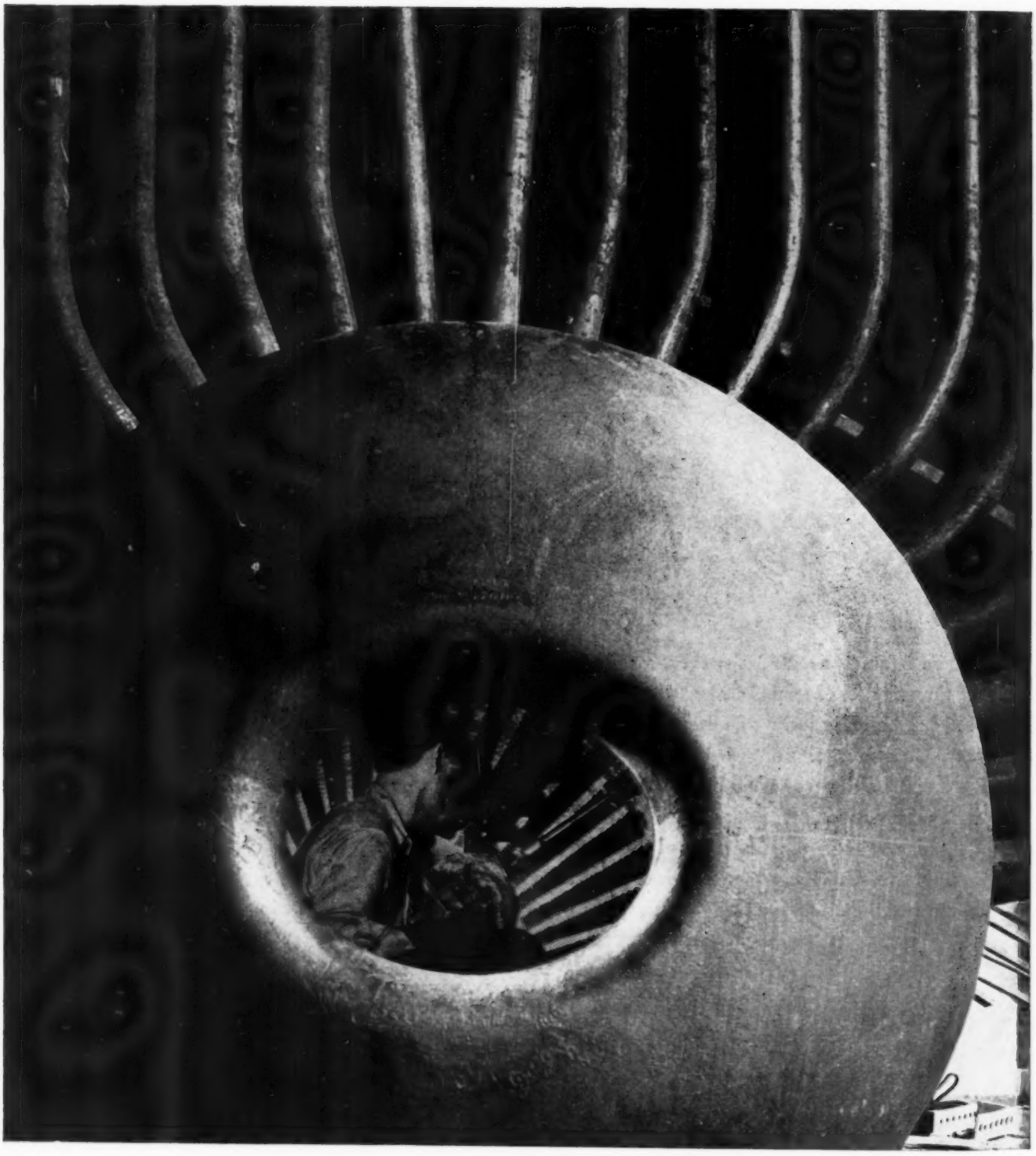
Hagan Corporation, Hagan Bldg., Pittsburgh 30, Pa.

HAGAN CORPORATION

HAGAN
HALL
BUROMIN
CALGON

BOILER COMBUSTION CONTROL SYSTEMS
RING BALANCE FLOW AND PRESSURE INSTRUMENTS
METALLURGICAL FURNACE CONTROL SYSTEMS
THRUSTORQ FORCE MEASURING DEVICES

AGAIN *in*



Cleveland it's ELECTRUNITE

. . . IN THREE NEW STEAM GENERATING UNITS FOR THE CLEVELAND ELECTRIC ILLUMINATING COMPANY

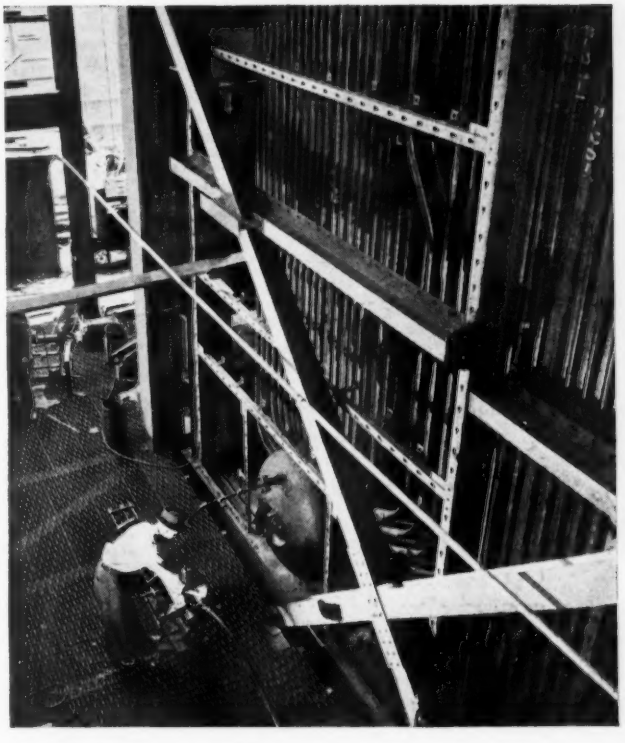
● Long one of the nation's foremost light and power companies, The Cleveland Electric Illuminating Company has played an important part in Cleveland's industrial growth—is nationally known for its promotion of *"Cleveland—The Best Location in the Nation."*

Included in a $93,000,000 current construction and improvement program is the rebuilding of one of two steam generating plants which provide heat for downtown Cleveland office buildings. Three new 150,000 pound per hour boilers—tubed with ELECTRUNITE—are replacing 11 small stoker-fired boilers, some of which have been in service for more than 45 years.

That Republic ELECTRUNITE Boiler Tubes are being used exclusively in the new boilers, is a strong indication of the safe, dependable service which these *modern* boiler tubes provide. Republic's improved process of electric resistance welding makes each tube tough and strong, yet highly ductile throughout its entire length . . . with soundness assured by rigid hydrostatic testing and a thorough inspection.

For complete information about the many cost-saving advantages of Republic ELECTRUNITE Boiler Tubes, write to:

REPUBLIC STEEL CORPORATION
STEEL AND TUBES DIVISION • CLEVELAND 8, OHIO
Export Department: Chrysler Building, New York 17, New York



Hydrostatic pressure test being conducted on one of the three new Combustion Engineering Boilers installed in The Cleveland Electric Illuminating Co's. Canal Road steam heating plant. Each of the new units is tubed throughout with Republic ELECTRUNITE Boiler Tubes.

Republic
REPUBLIC STEEL
ELECTRUNITE
Reg. U. S. Pat. Off.
BOILER, CONDENSER AND HEAT EXCHANGER TUBES

"...we have burned about every kind of coal--wet, damp and very fine dusty coal..."

a C-E performance story

A recent service report from Mr. Walter Gaumer, Power Plant Superintendent of Keystone Steel and Wire Company, Peoria, Illinois, eloquently verifies the operating advantages inherent in the C-E Continuous Discharge Spreader Stoker. Excerpts follow:

"... we have burned about every kind of coal – that is, extremely wet coal, damp coal and very fine dusty coal, with excellent results. We have operated at all ratings from 30,000 to 150,000 lb steam per hour without smoke or clinkers and with but very little fly ash. We remove fly ash only once in 24 hours and siftings every 3 or 4 days. It is surprising what a small amount accumulates in that period.... Our overall steam costs are at least 15 to 20 per cent lower since the new unit has been in service." B-204

This report, it is true, reflects the expert handling with which Mr. Gaumer operates his equipment, but it also emphasizes unmistakably the advantages of C-E Continuous Discharge Spreader Stoker design.

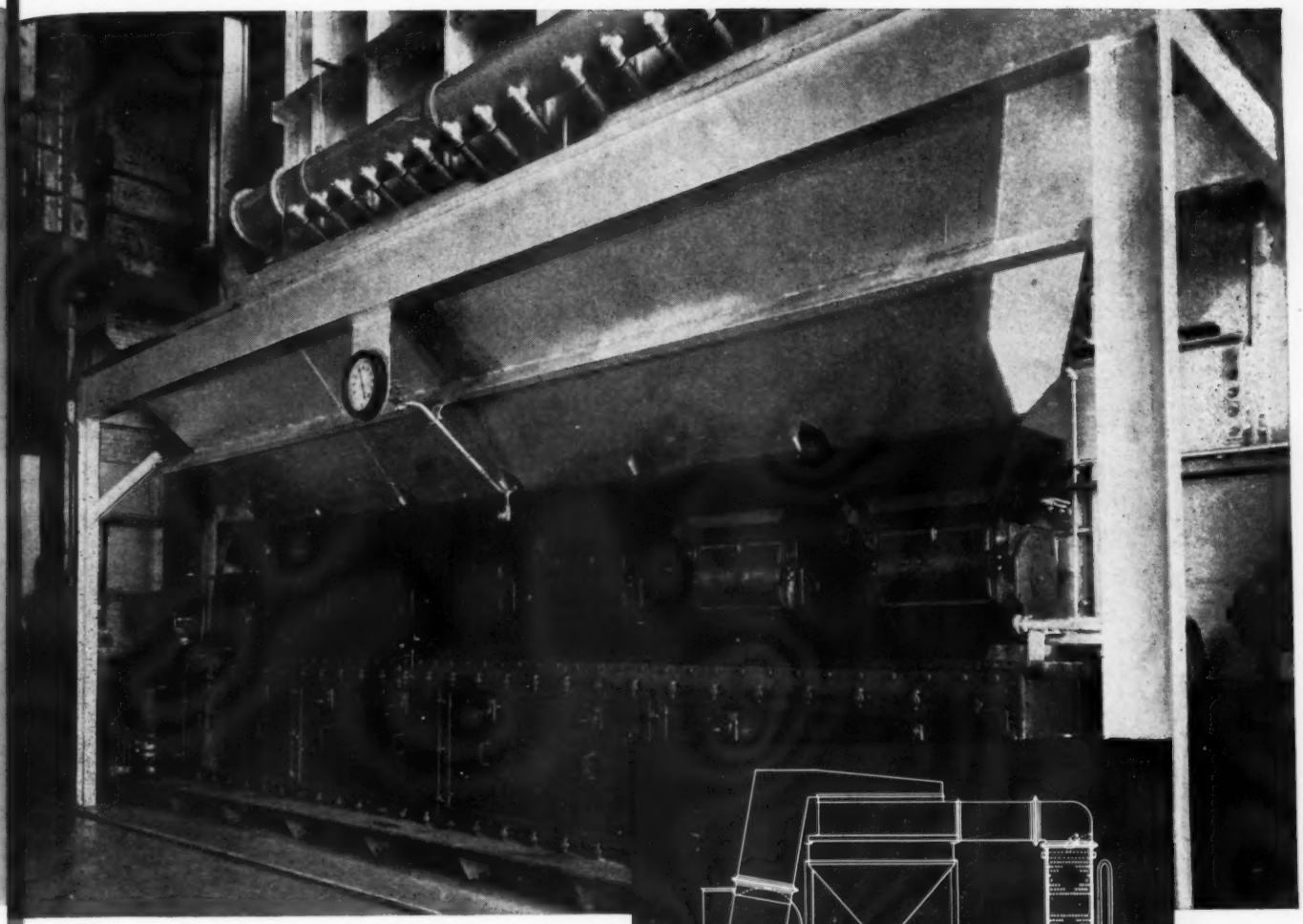
Combining the best features of spreader and travelling grate types, the C-E Continuous Discharge Spreader Stoker accommodates itself to widely varying grades of coal with a flexibility that permits close control of the fuel bed to meet any load requirements of the boiler.

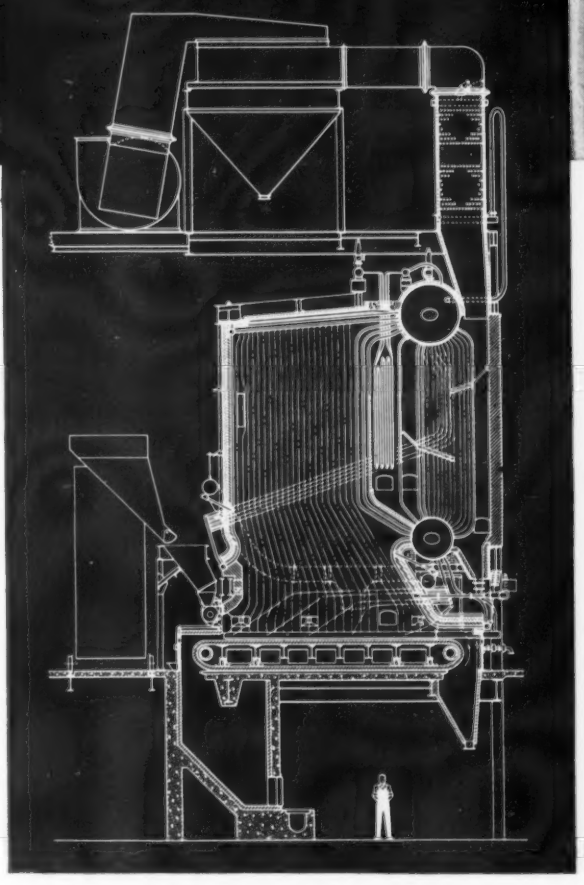
Into the C-E Continuous Discharge Spreader Stoker is built the experience of an organization that has equipped more boiler heating surface for stoker and pulverized coal firing than any other company in the world. You are invited to avail yourself of this experience in solving *your* stoker needs.

C·E

COMBUSTION

C-E PRODUCTS INCLUDE ALL TYPES OF BOILERS, FURNACES, PULVERIZED FUEL SYSTEMS AND STOKERS; ALSO SUPERHEATERS, ECONOMIZERS AND AIR HEATERS





The C-E Unit illustrated above and at the right was designed and built for the Keystone Steel and Wire Company, Peoria, Illinois, and first placed in service in May, 1947. It comprises a C-E Steam Generator, Type VU, equipped with an Elesco Superheater, a C-E Economizer and is fired with a C-E Continuous Discharge Spreader Stoker. The unit is designed to produce, at maximum continuous capacity, 150,000 lb of steam per hr at 450 psi and 750 F.

ENGINEERING

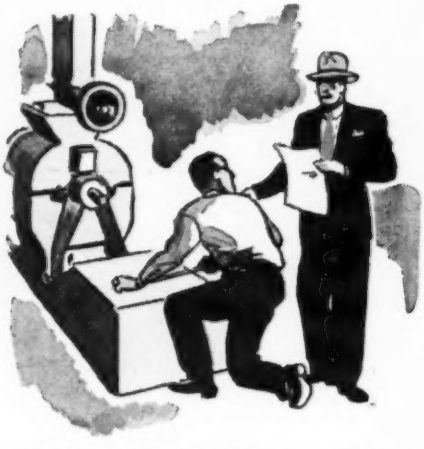
200 MADISON AVENUE • NEW YORK 16, N. Y.

Looking for Motors? Maybe We Can Help You!

ALLIS-CHALMERS AUTHORIZED DEALER

ALLIS-CHALMERS REPRESENTATIVE

Do You Need General-Purpose, squirrel-cage motors from 1 to 200 hp? Get in touch with your nearby Allis-Chalmers *Authorized Dealer* or District Office. Either may be able to help you from stock right now!



But For Really Big Motors — 250 to 25,000 hp and over — call your Allis-Chalmers *field engineer*. He's an *expert* on motors—can help you solve difficult drive problems, involving large or small motors, in the most economical manner.

Want Reliable Information on motor delivery? Call *either* your Allis-Chalmers dealer or district office. They have *up-to-the-minute* delivery information available to them!

Motor "Headquarters"—½ to 25,000 hp and Up!

YOU SELECT from a *wide range* of motors when you call on Allis-Chalmers.

And you can count on *expert* motor advice, too! The best possible motor selection is the result of careful appraisal of drive characteristics, the driven equipment, power source and surroundings. The best motor may not always be the first that meets the requirements.

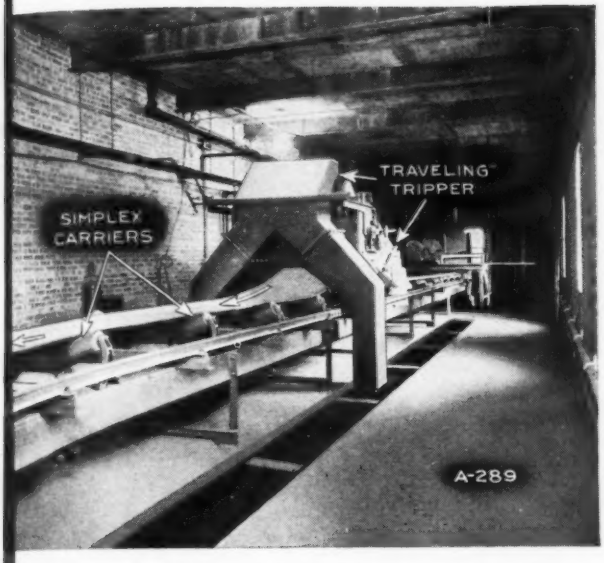
Allis-Chalmers authorized motor dealers or factory representatives can help you choose wisely. They can save you time and money. ALLIS-CHALMERS, MILWAUKEE 1, WIS. A 2401

The Delivery Picture's getting brighter! Our motor-building capacity has been greatly increased. We've put new methods, new equipment to work to turn out *more* motors for industry, faster!

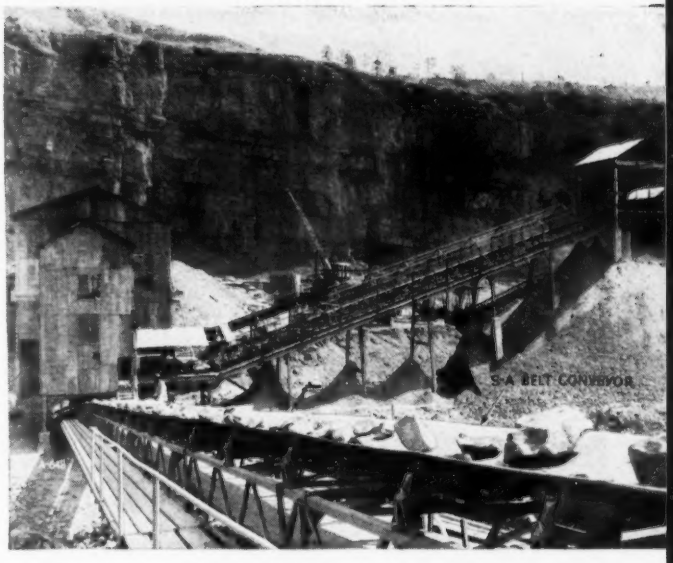
ALLIS-CHALMERS

One of the Big 3 in Electric Power Equipment—Biggest of All in Range of Industrial Products

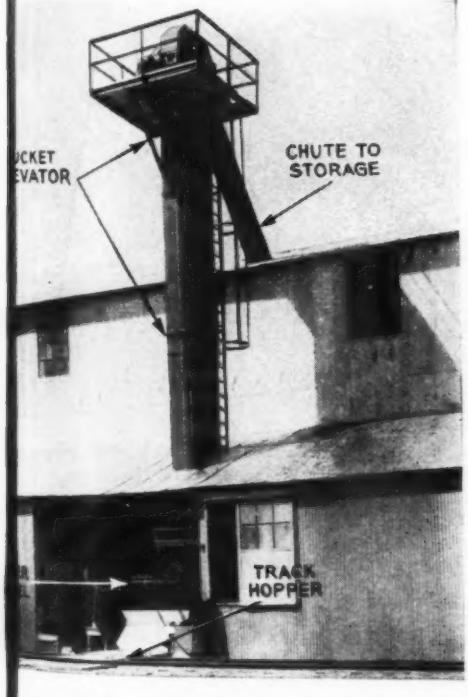
Which of these suggests an answer to your bulk material handling problems?



Handling Coal Your Problem? This is one of many S-A engineered answers. This system includes an S-A Belt Conveyor over a coal bunker in a power plant. Movable, self-propelled tripper on rails discharges coal from belt at any desired point. Idlers are S-A SIMPLEX type, equipped with Timken roller bearings. Find out about other cost-cutting S-A Conveyor Units and Systems. Write today.

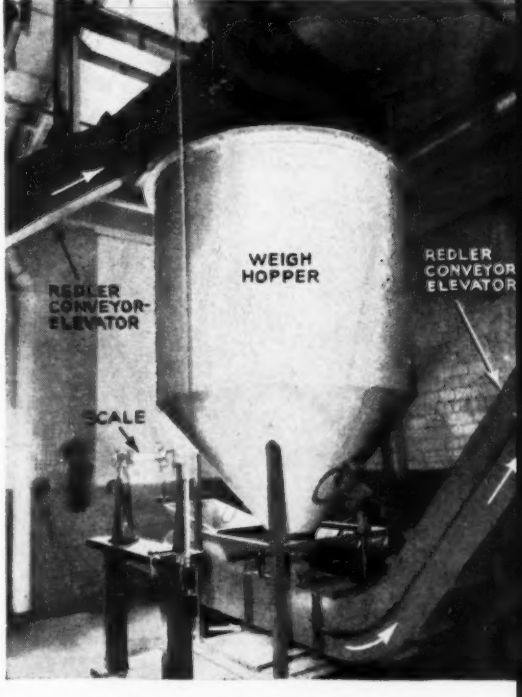


Is Your Problem Like This? This is an S-A Belt Conveyor handling riprap in a modern crushed stone plant. Belt conveyor is 48 in. wide, 165 ft. long; rolls on S-A PACIFIC type carriers equipped with Timken roller bearings. This engineered conveying system has reduced breakage, increased production, cut operating costs. Ask for full information on similar handling systems.



The Answer May Be a Bucket Elevator as engineered by S-A for this unloading and storage system for leading glassware manufacturer. Five kinds of materials brought in on rail cars are scooped into hopper by S-A power shovel...fed on short S-A belt feeder to bucket elevator...elevated and chuted through roof to S-A shuttle belt conveyor...discharged into five individual bins. Full data on request.

Study This REDLER System. Here the upper REDLER Conveyor discharges into cylindrical scale hopper. Second REDLER Conveyor-elevator takes material to mixer units. Both REDLERS handle material from storage to mixing without exposure to contamination or spillage. Plant shown produces penicillin. Write us for full data on dust-tight, compact REDLER conveying and elevating systems.



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5 RIDGEWAY AVENUE, AURORA, ILLINOIS — LOS ANGELES, CALIF. ★ BELLEVILLE, ONT.

Designers and Manufacturers of All Types of

BULK MATERIAL HANDLING EQUIPMENT

Because of their Better cost us LESS

Fig. 2228
Bronze Union Bonnet
Gate Valve

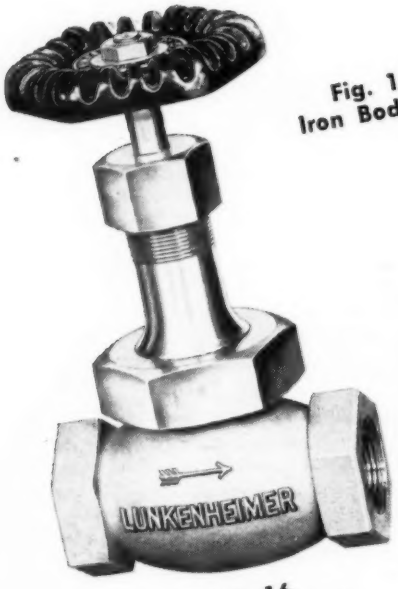

Fig. 16
"Renewo Globe"

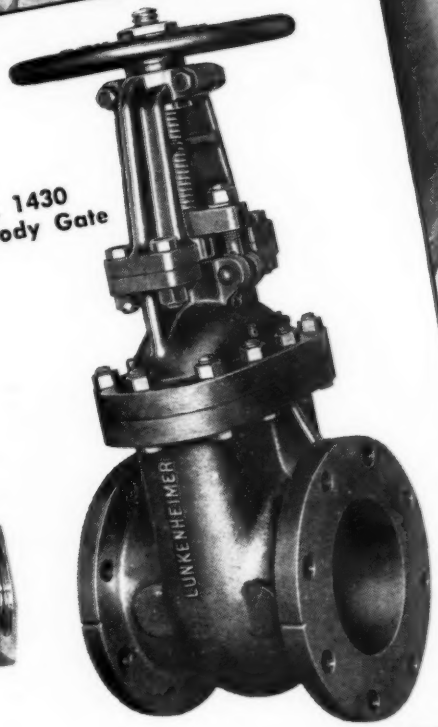

Fig. 1430
Iron Body Gate

BRONZE, IRON, STEEL, AND CORROSION RESISTANT ALLOY VALVES
AIR DEVICES, LUBRICATORS, AIRCRAFT FITTINGS

Quality LUNKENHEIMER VALVES *per Year of Service!*

IN buying a valve, as in buying anything else, it's *value* you're really after.

What is the measure of valve value? Length of service, efficiency of performance, time and expense required for maintenance—these are the *principal* factors.

Lunkenheimer Valves, in these and in all other elements of value, have long proved their superior worth throughout American industry. Maintenance men everywhere rely implicitly on these *better valves* because they know they are *better values . . . quality-built in every detail,* assuring longer and more efficient service with the very minimum of maintenance trouble and expense.

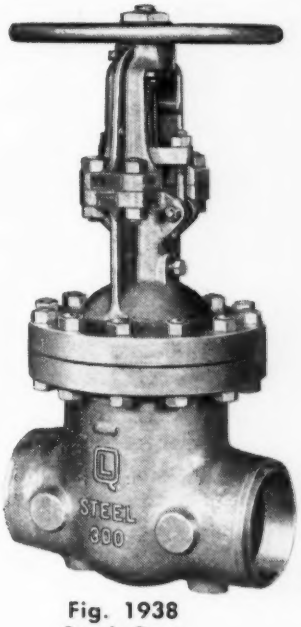

Fig. 1938
Steel Gate

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THE LUNKENHEIMER CO.

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Your LUNKENHEIMER DISTRIBUTOR Provides Better Valve Service . . .

Lunkenheimer Distributors are located in the principal industrial centers. There is one near you, fully equipped and ready at all times to assist with your maintenance and operation problems. Call on him.

LUNKENHEIMER VALVES

Reliance EYE-HYE

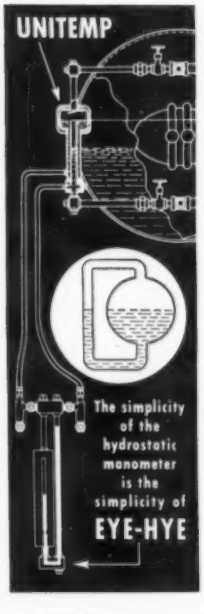
brings you accurate fool-proof remote water-level reading for any boiler or tank

Standard equipment in thousands of power plants

● This dependable step-saving remote reading gage brings boiler water level indication down to eye level—indicates clearly in green fluid, brightly illuminated—unmistakable. When you've installed your first EYE-HYE, you recognize its potential value on all liquid-containing vessels, as a guard against liquid level accidents—as a help in achieving operating efficiency. Besides the main boilers you can use EYE-HYE on heater tanks, flash tanks and various types of storage vessels—even on sizes with level variation up to 12 feet.

Hydrostatic operation means constant full-range accuracy; factory calibration eliminates adjustments on location: EYE-HYE can't be tampered with in service. Easy to install—practically no maintenance. Can be placed in any convenient location where operators can see and read it *frequently*. . . . It pays you to learn more about the EYE-HYE. Write for full particulars.

For the fellow who likes to know how things work, here's the story of EYE-HYE's a-b-c Simplicity



EYE-HYE operates on the principle of the U-tube manometer. EYE-HYE itself forms the bottom of the U; two tubes connecting it to the boiler drum complete the two legs.

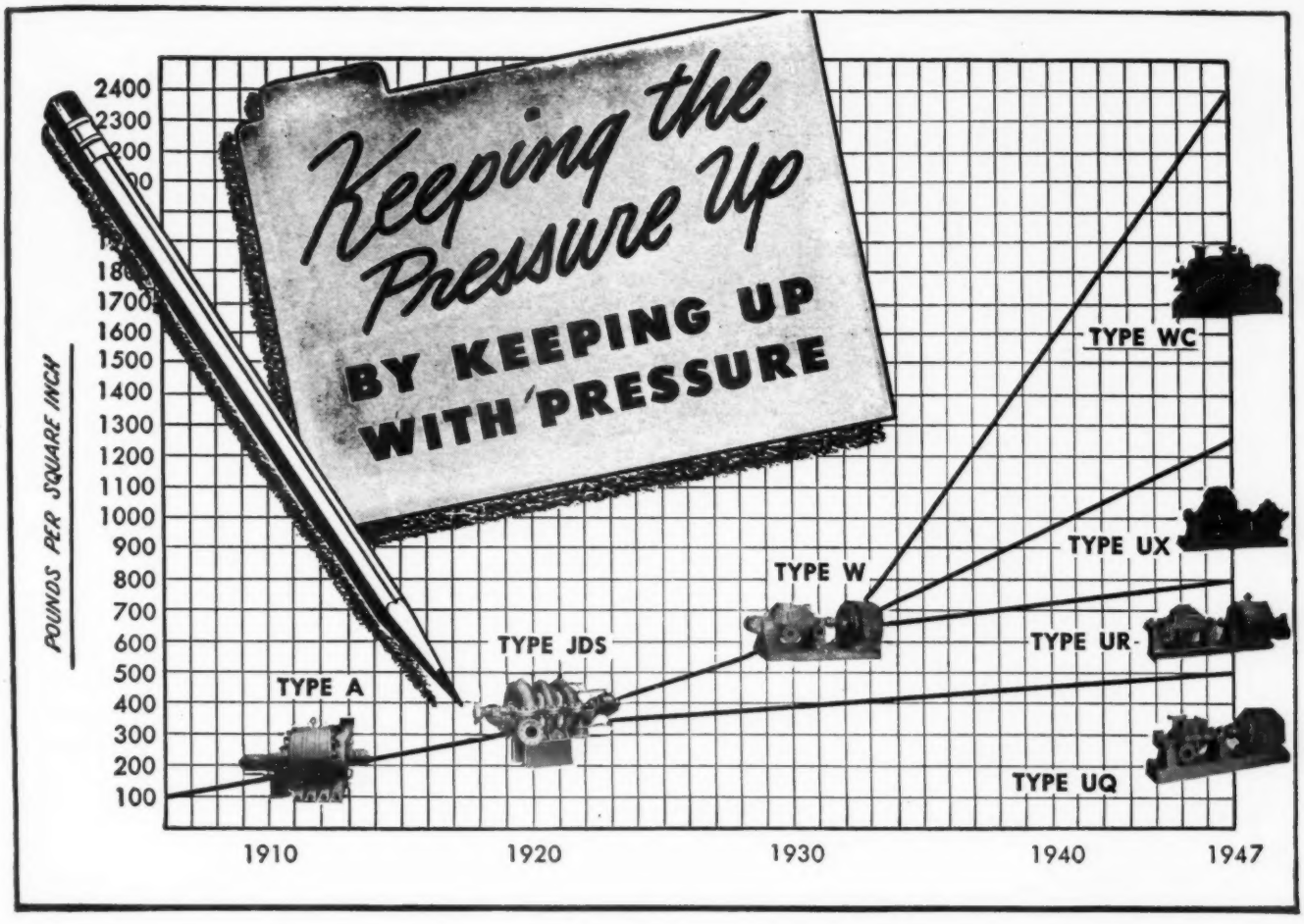
Condensation of steam in the special reservoir—the Unitemp—maintains a level of water in one leg of the EYE-HYE hookup equal to the predetermined maximum *high* water level in your boiler. As water in the boiler rises or falls it exerts a varying pressure on the opposite leg. Unitemp also equalizes the *temperature,* and therefore the specific gravity, of water in both legs.

Counter-balancing these two pressures is a high specific gravity liquid in the bottom of the U-tube which will not mix with water, so water in the two legs pushes it back and forth according to the difference in hydrostatic head pressure. Thus the liquid (of a rich green color) is always in the same relative position between the two columns of water . . . and becomes the visual indication of the rise and fall of water level in the boiler.

BOILER SAFETY DEVICES since 1884

Reliance

THE RELIANCE GAUGE COLUMN CO. · 5902 CARNEGIE AVENUE · CLEVELAND 3, OHIO



The graph shows you how closely Worthington has kept pace with industry's demands through the years . . . by developing centrifugal pumps to handle steadily mounting boiler feed pressures.

It's a record of steady progress . . . from the old Type A, a great performer at 200 psi . . . to the powerful modern Types WC, UX, UR and UQ, with pressures ranging from 2½ to 12 times the 1910 "ceiling".

THE LONGEST AND BROADEST EXPERIENCE

In addition, out of Worthington's more than 100 years of pioneering in pump design and manufacture have come such notable improvements as the Elastic Seal Ring for tight interstage joints in axially split-case pumps . . . the Metal-to-Metal Ring Type Joint in solid-case barrel pumps.

FOR YOUR OWN BOILER FEED REQUIREMENTS

Worthington has the most complete line of centrifugal pumps — all pressures, all capacities — and engineers trained to fit feed pump to feed cycle for maximum economy and dependability.

For details that prove *there's more worth in Worthington*, contact our nearest District Office. Or write to *Worthington Pump and Machinery Corporation, Centrifugal Pump Division, Harrison, N. J.*

MEMBER HYDRAULIC INSTITUTE

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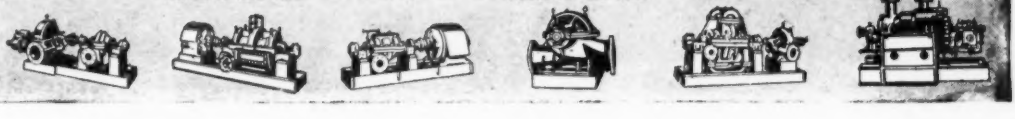
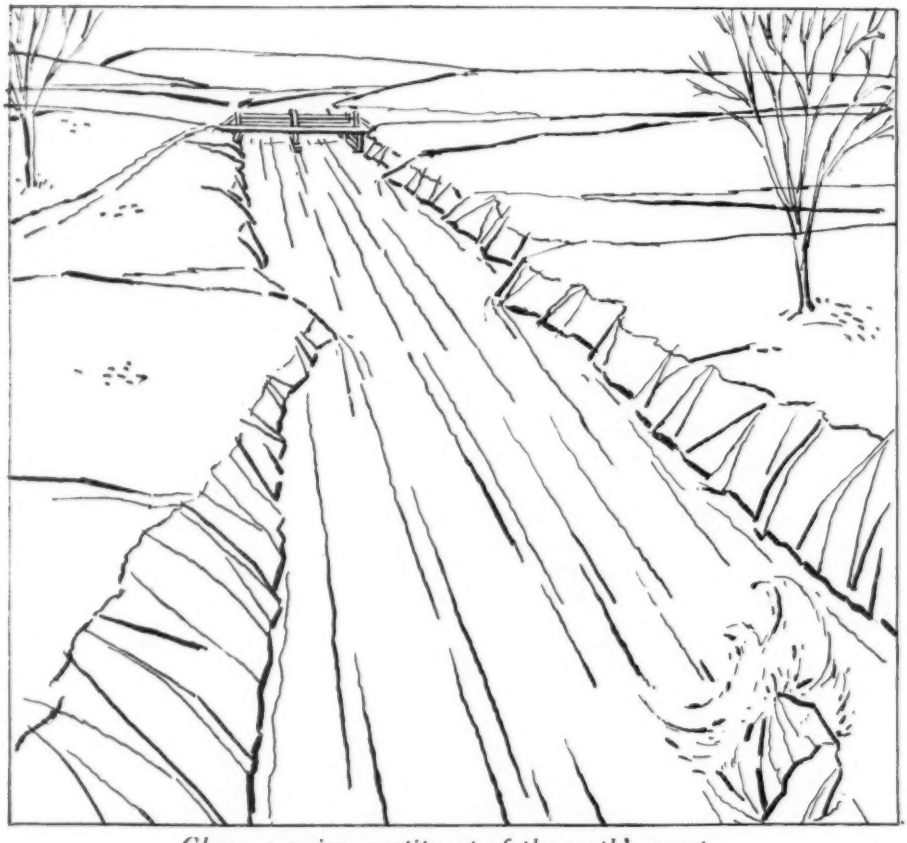
THE WORLD'S LARGEST MANUFACTURER OF PUMPS


For Boiler Feed Service
Capacities to 1500 GPM
Heads to 1000 Ft.
For Hotwell, Condensate, Chilled Water Service
Capacities to 1400 GPM
Heads to 650 Feet
For Boiler Feed Service
Capacities to 1500 GPM
Heads to 1600 Feet
For Water Works, Circulation, Drainage, General Service
Capacities to 135,000 GPM
Heads to 400 Feet
For Boiler Feed Service
Capacities to 1600 GPM
Heads to 3500 Feet
For Boiler Feed Service
Capacities to 3000 GPM
Heads to 7000 Feet

Effective water treatment



Clay—a major constituent of the earth's crust—is present in most waters as aluminum silicate.

APPROXIMATE knowledge in water-conditioning work isn't enough. It is necessary not only to know the major result of a conditioning procedure and the principal change taking place at a given stage, but also to foresee the probable indirect results.

Take, for example, a typical water containing too much hardness for boiler use, but with suspended solids low enough to make preliminary filtering seem unnecessary. Only softening appears to be required.

Suppose, however, that the suspended ma-

HAGAN
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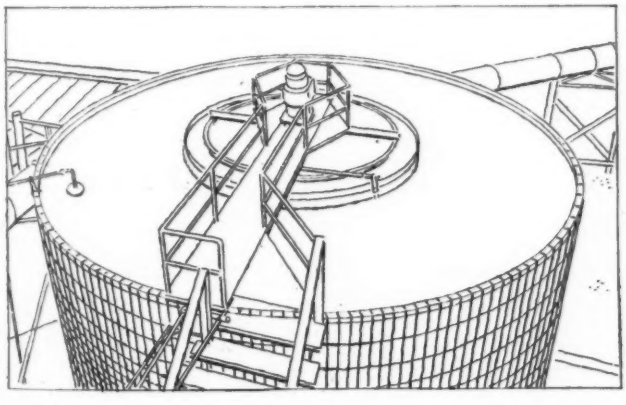
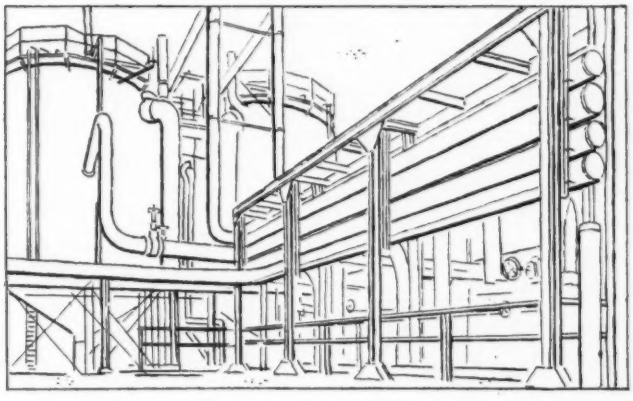
CALGON

requires *full* knowledge

terial is clay—a source of alumina and silica—and that hot-process softening is the preferred method. With this method, water becomes hot and alkaline, and under these conditions tends to dissolve the clay. Alumina and silica then are not removed by filtering but are carried into the boiler where they may help to form scale. Cold coagulation and filtering before softening, while the clay is still unattacked, is indicated.



Cold coagulation and filtering before softening easily removes clay—a source of dissolved alumina and silica.



With prior filtration, hot-process softening develops no dissolved alumina and silica to be carried on to the boilers and cause scale.

The procedures recommended by Hall Laboratories take account of *all* factors which enter into a problem and represent the most economic and efficient solution in your specific situation.

Every problem concerning the use of water in industry comes within the scope of Hall Laboratories. Correspondence concerning such problems is invited. Hall Laboratories, Inc., Hagan Building, Pittsburgh 30, Pa.

HALL LABORATORIES, INC.

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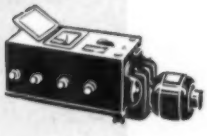
INDUSTRIAL WATER TREATMENT
HALL SYSTEM OF BOILER WATER CONDITIONING
INDUSTRIAL WASTE RECOVERY AND DISPOSAL

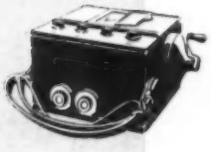
which "Megger"* testing instrument will solve your resistance measurement problem?

* REG. U. S. PAT. OFF.

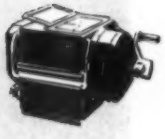
Whether your problem involves *insulation resistance, conductor resistance,* or *ground resistance,* there's a "Megger" Testing Instrument to help you . . . quickly, easily, accurately.



For your problem in INSULATION RESISTANCE



Four different types, and many ratings of *"Megger" Insulation Testers* are *available* for use on all types of electrical apparatus, including generators, motors, cables, transformers, switch-boards, appliances, wiring; telephone, telegraph and radio equipment. For detecting grounds and short circuits; for determining the presence of moisture, dirt, oil and other detriments to insulation. For tests while drying out moisture, and for periodic tests to forestall breakdown.



For your problem in CONDUCTOR RESISTANCE

Use one of many ranges of *"Megger" Ohmmeters* for field, shop and laboratory measurements of ohmic resistance of coils, resistors, circuits, rheostats, appliances, etc. Or, use the *"Ducter" Low Resistance Test Set* for very low resistance measurements of contacts, soldered joints, bus-bars, armature coils, series field coils, transformer windings and bonding resistances . . . a truly unique set for field measurements that reads as low as .000001 ohm.

For your problem in GROUND RESISTANCE

There's the *"Megger" Ground Tester* for measuring resistance to earth of ground connections, such as generating stations, substations, transmission towers, lightning arrester grounds, etc. Also for earth resistivity and special ground resistance measurements in studies of inductive coordination, in electrical protection of pipe lines and in geophysical prospecting.

Whatever your resistance measurement problem, you'll find a *"Megger" Testing Instrument,* designed and engineered to fit your specific problem, fully described, fully illustrated in one of our many "Megger" bulletins. Write, stating your problem.

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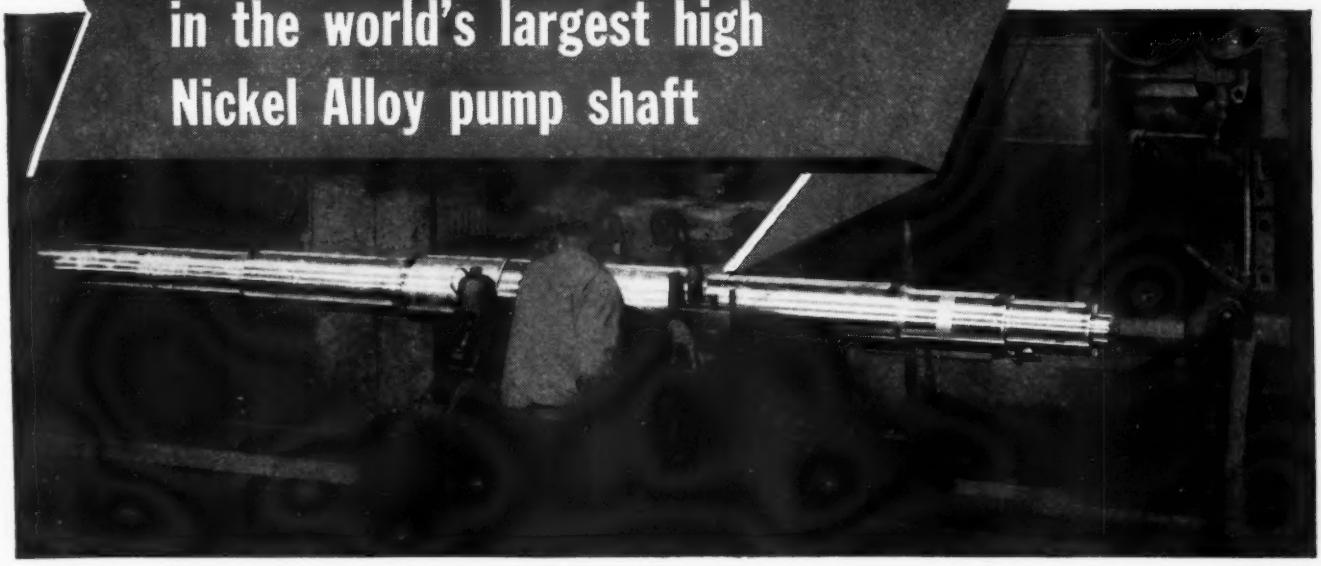
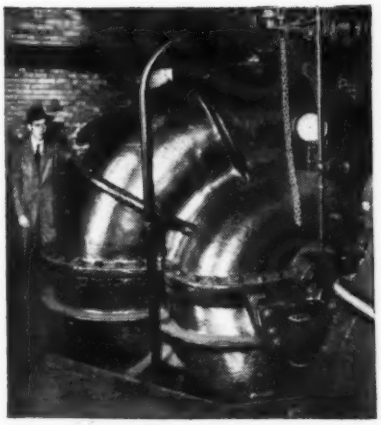
Why Consolidated Edison invested in the world's largest high Nickel Alloy pump shaft



World's largest high nickel alloy pump shaft. It was forged at INCO's Huntington, W. Va. mill, and machined by the Ingersoll-Rand Company, Phillipsburg, N. J. The forging weighed 3343 pounds. The shaft's finished dimensions were: length, 13 ft. 7⅛ in.; diameter, 9.005 in.



One of two huge centrifugal pumps installed at the 14th Street plant of the Consolidated Edison Company of New York. The pumps were built by the Ingersoll-Rand Company.

In the 14th Street plant of the Consolidated Edison Company of New York, there are two large condenser circulating pumps. They are giants of their kind, together handling 160,000 gallons of water every minute. But for 19 years, they have been ailing. The cause of their malady is the polluted salt water they pump from New York's East River. Corrosive action, plus fatigue caused repeated failures of the pump shafts.

The shafts originally installed were mild steel. These failed in relatively short time, and were replaced by others of the same metal. When these, too, failed, alloy steel shafts were tried. But these fared little better, and Consolidated Edison engineers decided the time had come to stop experimenting with metals that were not sufficiently resistant to corrosion and fatigue.

From their own experience with Monel* shafts in smaller pumps, and knowing that Monel and "K"* Monel are U. S. Navy standard metals for salt water pump shafts, the Consolidated Edison Company selected "K" Monel for this important job. This heat treatable grade of Monel provides extra strength, stiffness, and hardness for bearing surfaces.

The Consolidated Edison Company expects long and trouble-free service from this new shaft, because **MONEL** has the necessary combination of properties to withstand severe stress-corrosion conditions. **MONEL** is rustproof, corrosion-resistant, tough, and stronger than most structural steels.

INCO Nickel Alloys can extend the life of your pumps, valves, gaskets, packing, tanks, heat exchangers, and other equipment. For help in solving your power plant corrosion problems, write for "Individualized INCO Nickel Alloys." It is free.

THE INTERNATIONAL NICKEL COMPANY, INC.

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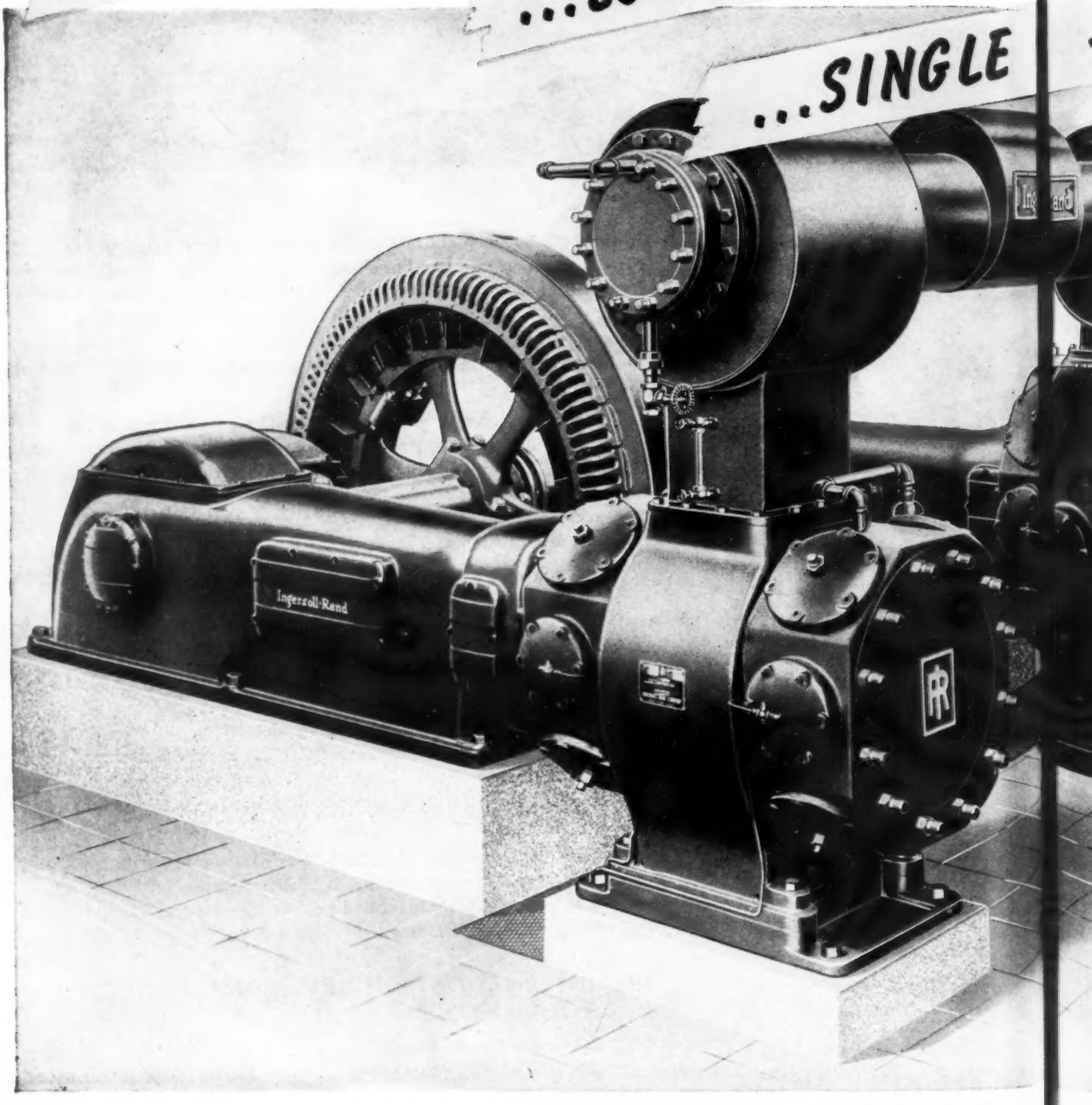

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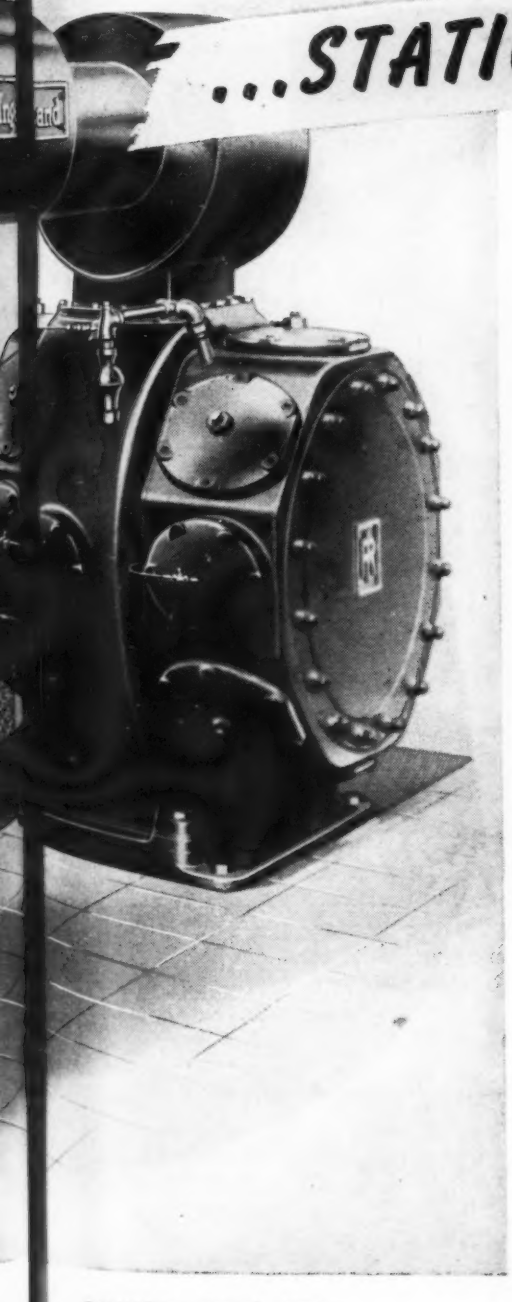

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This New Manual Lists them for Quick Reference

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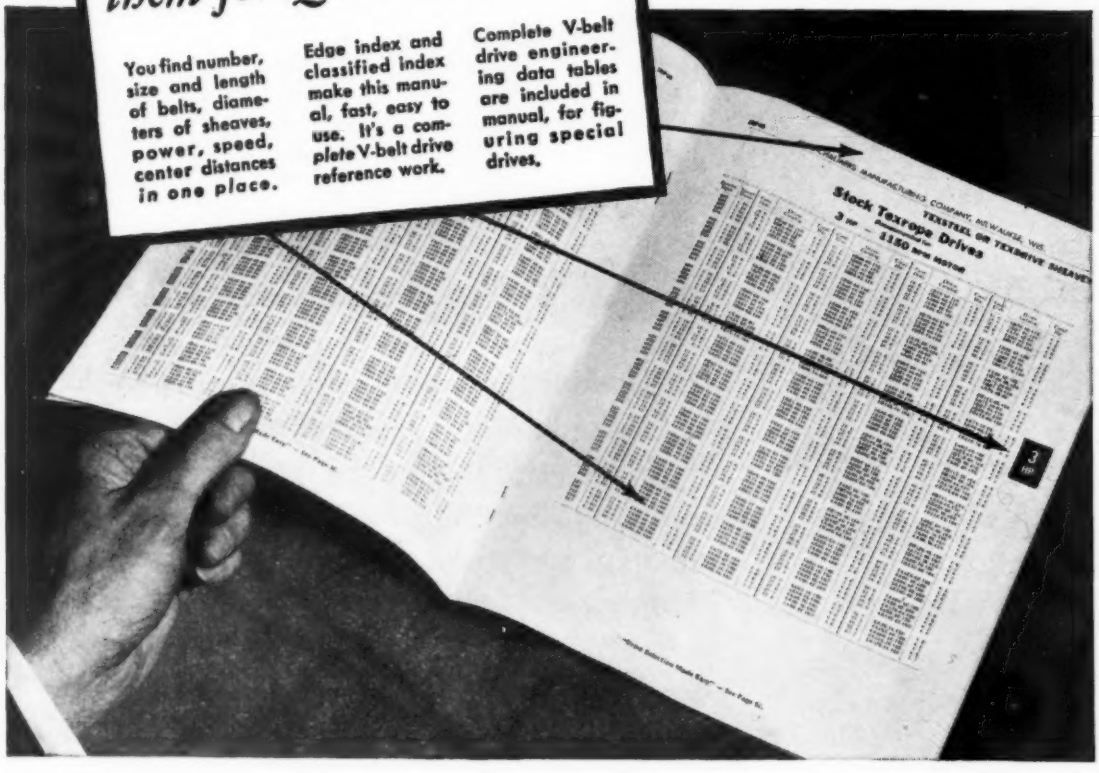
Edge index and classified index make this manual, fast, easy to use. It's a complete V-belt drive reference work.

Complete V-belt drive engineering data tables are included in manual, for figuring special drives.



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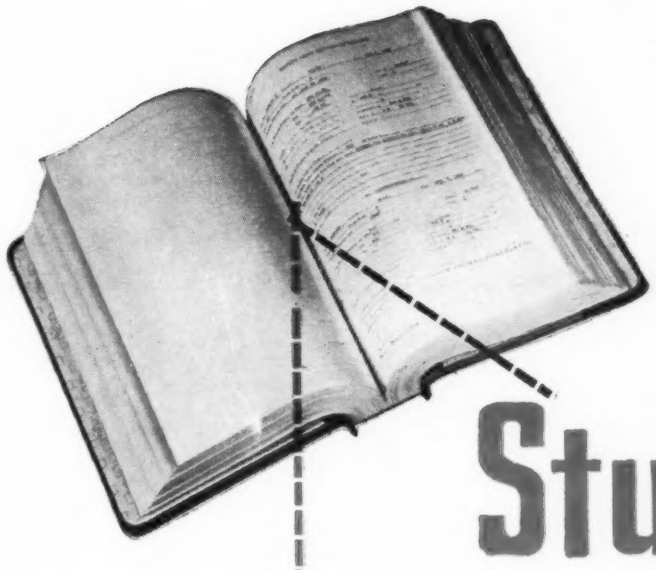
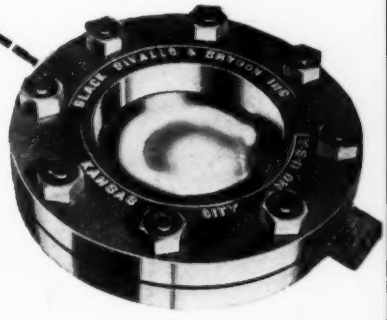


Stud Book



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"HAS OPERATED 99% OF THE TIME SINCE 1939"

reports the City of St. Mary's, Ohio, of their first 2500 KW Worthington Turbine Generator.

New 2500 KW Worthington Turbine Generator recently installed in municipal power plant of the City of St. Mary's, Ohio.

Mr. George Probst
Worthington Pump and Machinery Corporation
Steam Turbine Division
Wellsville, New York

Dear Mr. Probst:

You will be interested, I'm sure, to learn that our new 2500 KW Worthington Turbine Generator has been running continuously since it was put on the line about six months ago.

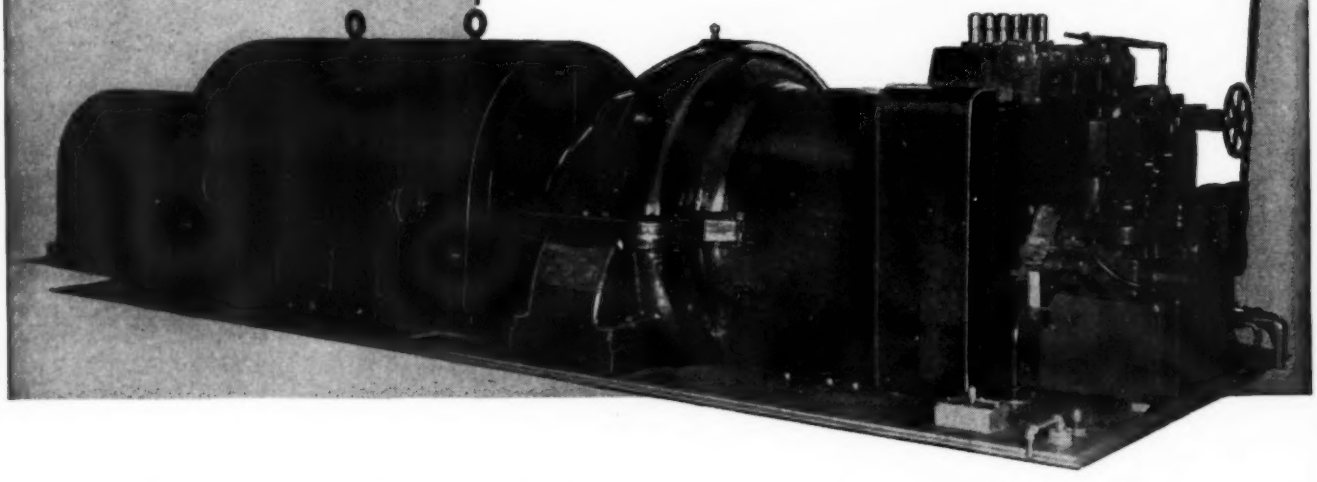
It's been eight years now since our original 2500 KW Worthington unit was started and it has operated 99% of the time ever since. On a number of occasions, it has carried loads of 3000 to 3500 KW for periods of three to four hours. We run both units a large portion of the time and they parallel very nicely.

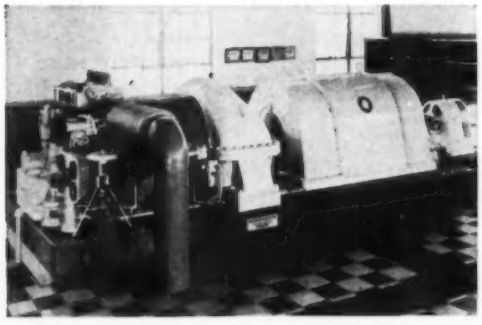
In fact, we do so well with these Worthington units that we would be glad to show them in operation to any of your prospective customers who care to visit our plant.

Very truly yours,
CITY OF ST. MARY'S

J M Hageman

City Engineer and Director
of Service and Safety





2500 KW Worthington unit installed in 1939. Turbine, straight, condensing type, operates on 400 lbs. steam pressure, 750 degrees total temperature and exhausts into a vacuum of 28"

Many similar reports from power users throughout the country testify to the trouble-free, cost-saving performance of Worthington steam turbine equipment. In your own turbine problems, Worthington specialists are always available for expert technical advice. And for further proof that *there's more worth in Worthington*, write for fact-full literature. *Worthington Pump and Machinery Corporation, Steam Turbine Division, Wellsville, N Y.*

WORTHINGTON

T7-1

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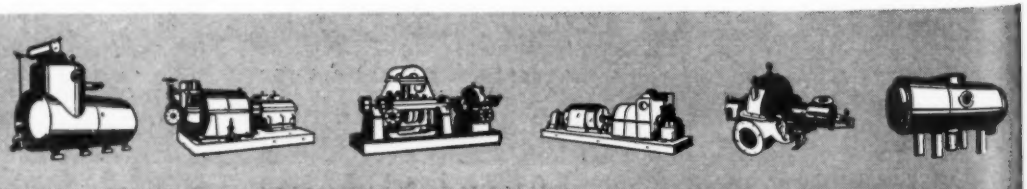

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HERE is case history evidence that CARBOFRAX silicon carbide tile can stand up under punishment that quickly causes ordinary refractories to fail.

The baffle indicated in this drawing of a bent tube boiler is subject to rigorous spalling and erosive conditions. Fireclay tile used in this trouble spot lasted only four to six weeks. The boiler was shut down repeatedly for baffle replacement. Output dropped. Maintenance costs jumped.

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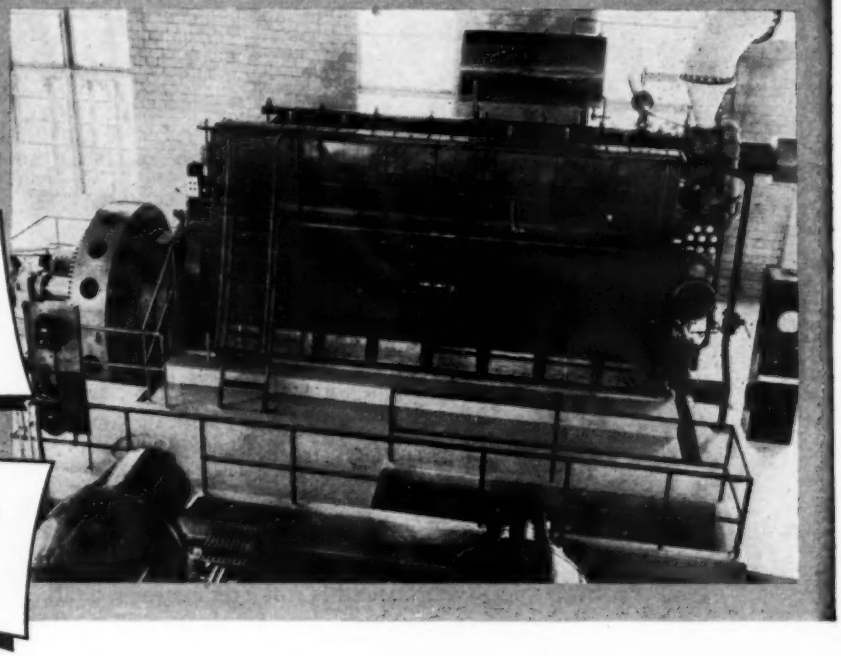

* Developed by this Worthington Supercharged Dual Fuel Diesel Engine, Type SEHGO-8, on acceptance test at the municipal plant, Lamar, Colorado.

* TEST DETAILS: 7050 net Btu per brake horsepower-hour at full load . . . total gas and pilot oil fuels included . . . elevation 3600 ft.

First in the U. S. to produce a 4-cycle Dual Fuel Diesel . . . first in the world to supercharge this type of engine . . . Worthington offers the Lamar data as proof of *thinking ahead* in Diesel engineering. But such records are only part of the Worthington economy story. Today, with a scarcity of all fuels in prospect, you can save by

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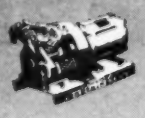
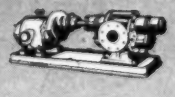


Air King Compressors



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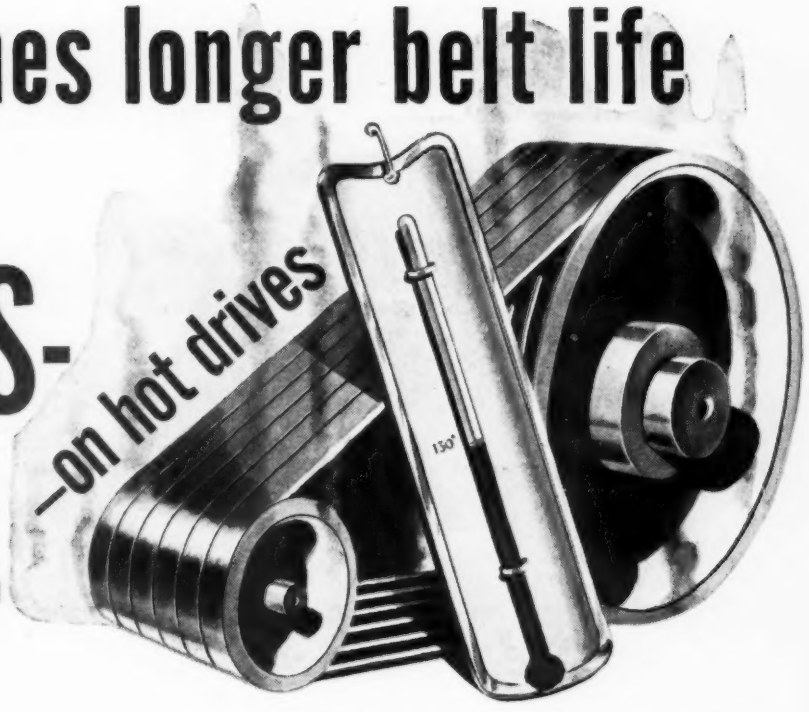

—on hot drives

A LARGE New England paper mill had constant trouble V-belting their blowers. Due to the difficult operating conditions, the wide temperature ranges, conventional cord belts lasted at most six weeks.

Then the G.T.M.—Goodyear Technical Man—recommended Goodyear COMPASS-V-STEEL Belts. That ended the belt trouble. Today these steel cable belts have entirely replaced the cord variety. And, depending on temperature conditions, their average life is 3 to 6 months—*2 to 4 times longer.*

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The G.T.M. will be glad to give you the full story on these miraculous new belts; how their economies can be applied to your operations. Just write: Goodyear, V-Belt Sales Dept., Akron 16, Ohio or Los Angeles 54, California.

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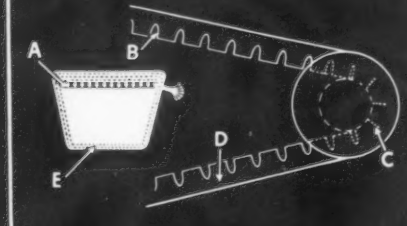
GTM-Specified COMPASS-V-STEEL BELT

for all types of V-drives



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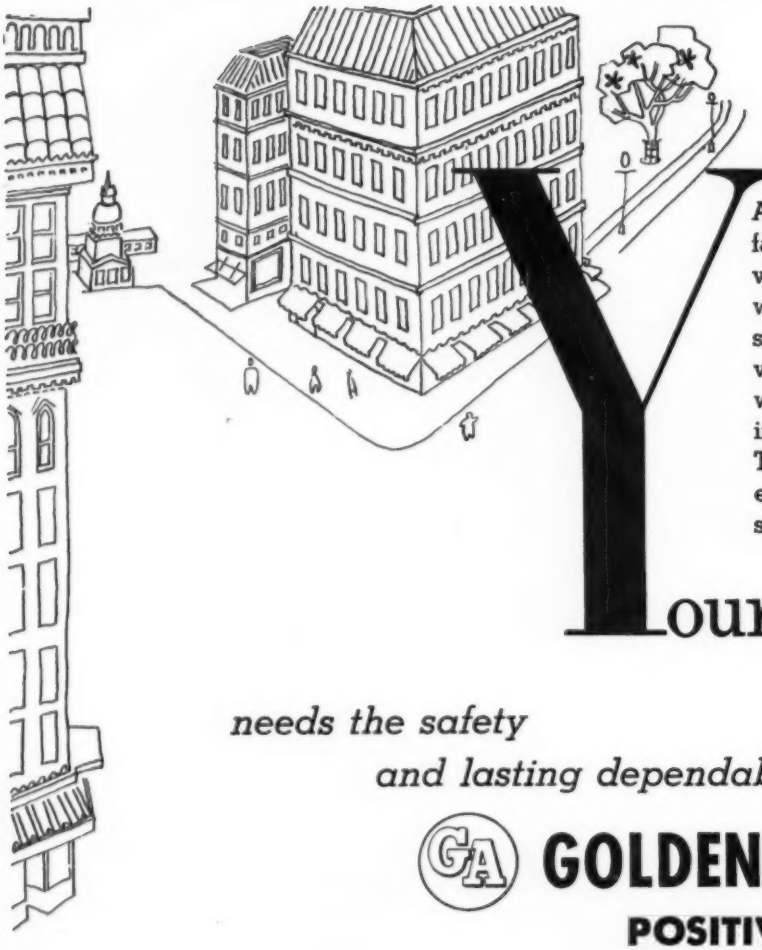

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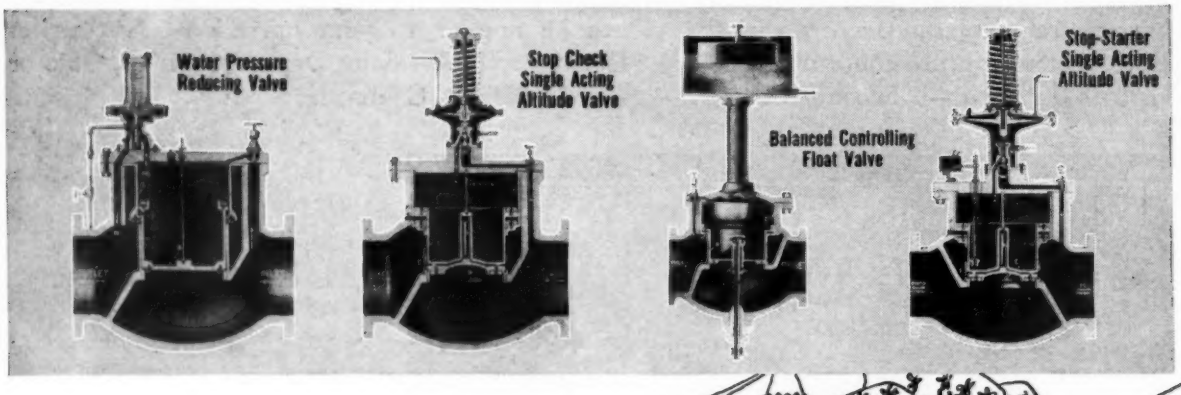
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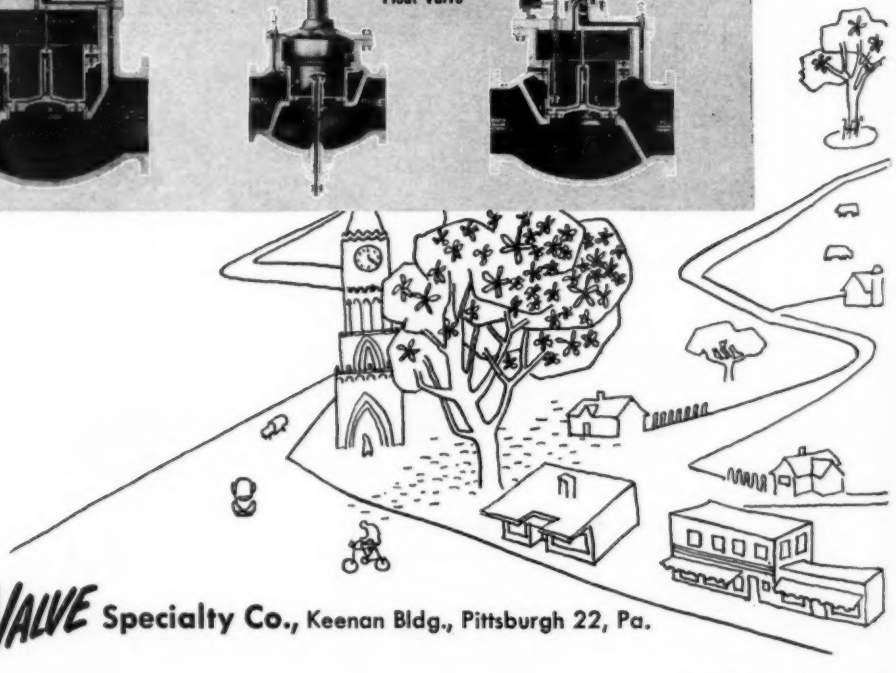
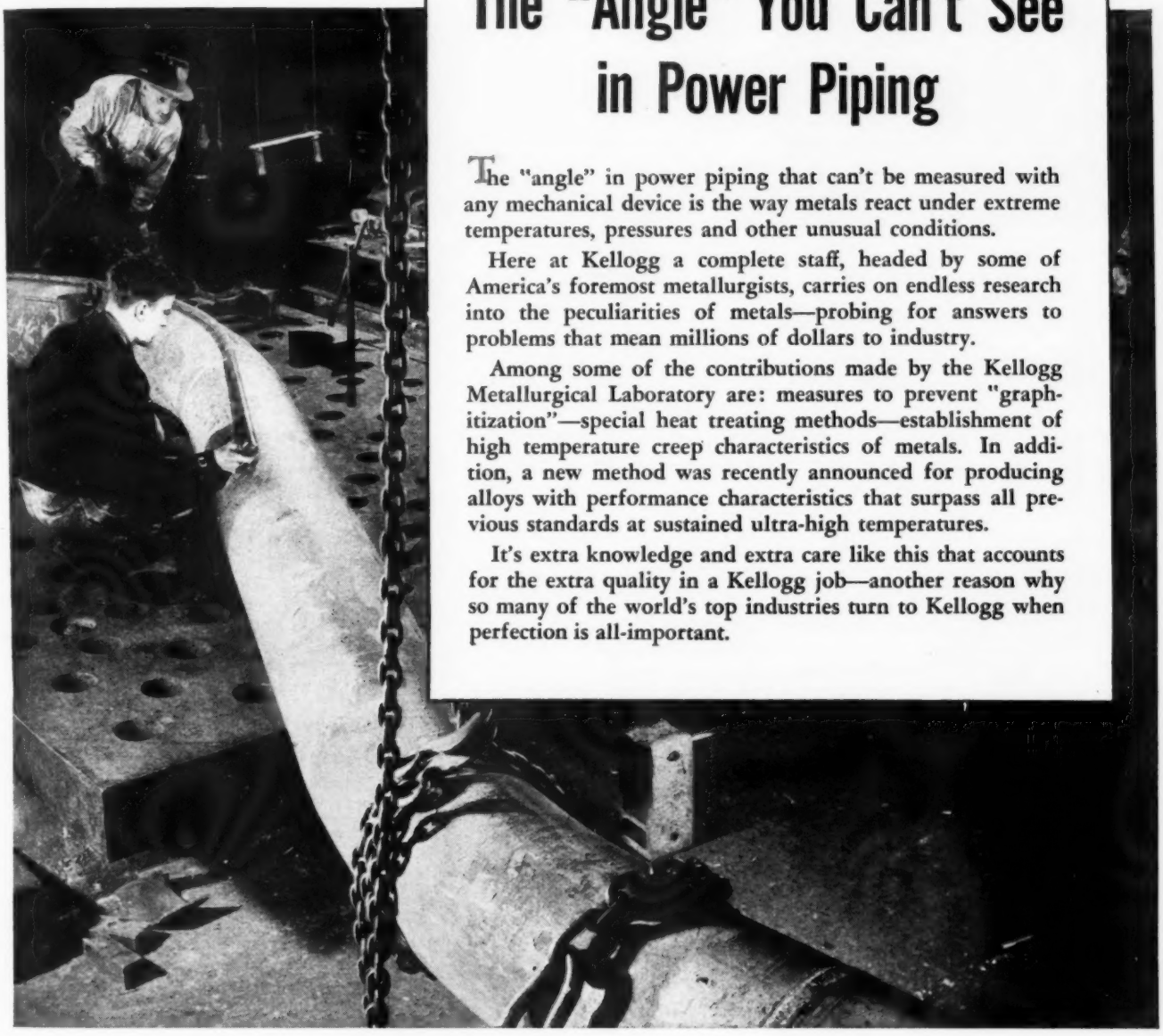


GOLDEN-ANDERSON VALVE Specialty Co., Keenan Bldg., Pittsburgh 22, Pa.

The "Angle" You Can't See in Power Piping



The "angle" in power piping that can't be measured with any mechanical device is the way metals react under extreme temperatures, pressures and other unusual conditions.

Here at Kellogg a complete staff, headed by some of America's foremost metallurgists, carries on endless research into the peculiarities of metals—probing for answers to problems that mean millions of dollars to industry.

Among some of the contributions made by the Kellogg Metallurgical Laboratory are: measures to prevent "graphitization"—special heat treating methods—establishment of high temperature creep characteristics of metals. In addition, a new method was recently announced for producing alloys with performance characteristics that surpass all previous standards at sustained ultra-high temperatures.

It's extra knowledge and extra care like this that accounts for the extra quality in a Kellogg job—another reason why so many of the world's top industries turn to Kellogg when perfection is all-important.

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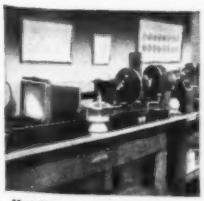
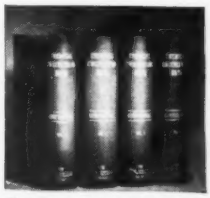


Metallurgical Research conducted continually by recognized specialists who have made major contributions in this field.



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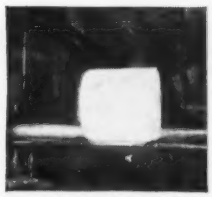

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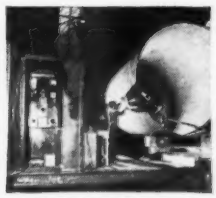

Quality Control embracing the constant application of the most advanced inspection methods, both visual and non-destructive.

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*Other single and multi-conductor cables up to 5000 volt rating—also with lead sheath, armor or lead sheath and armor coverings.

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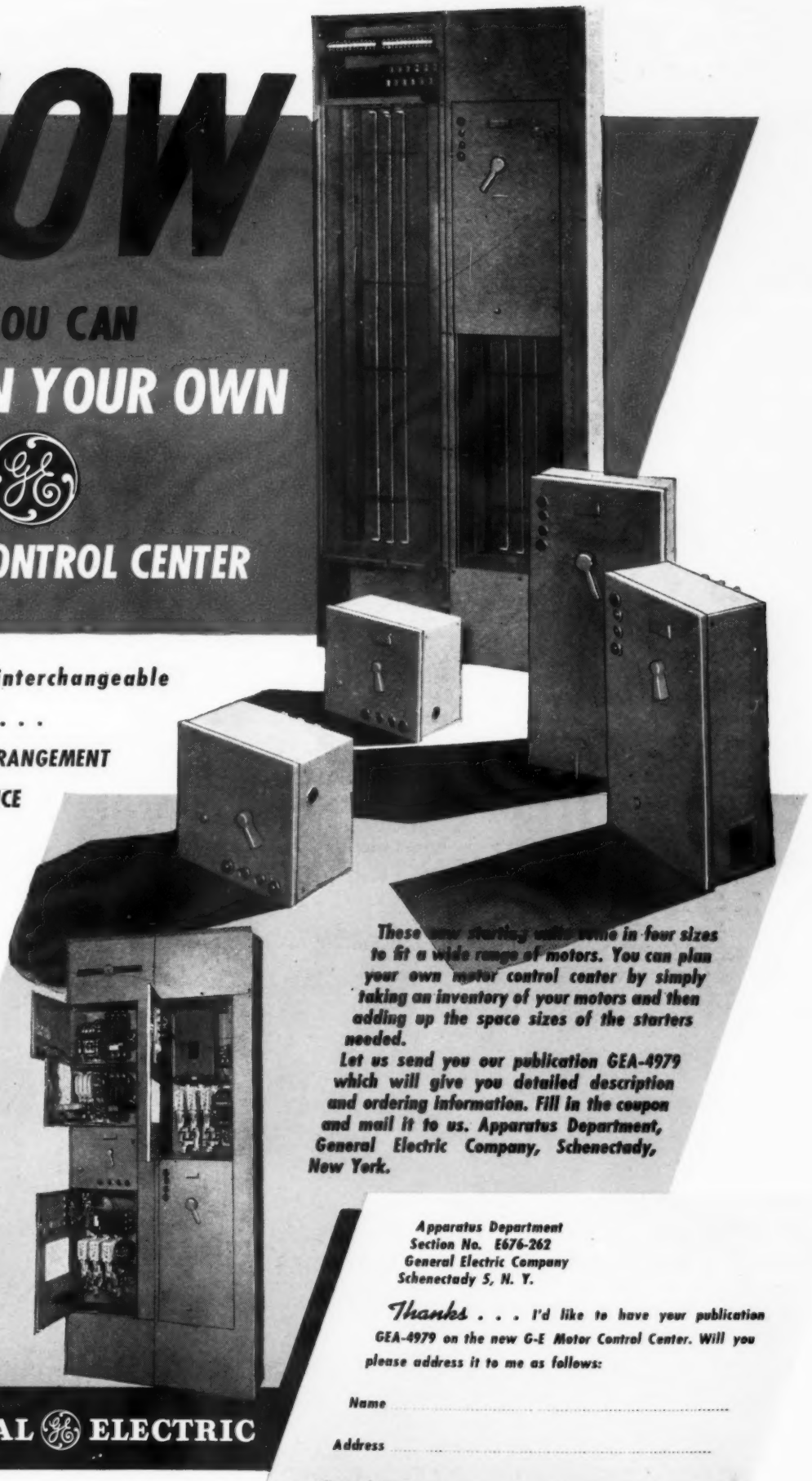

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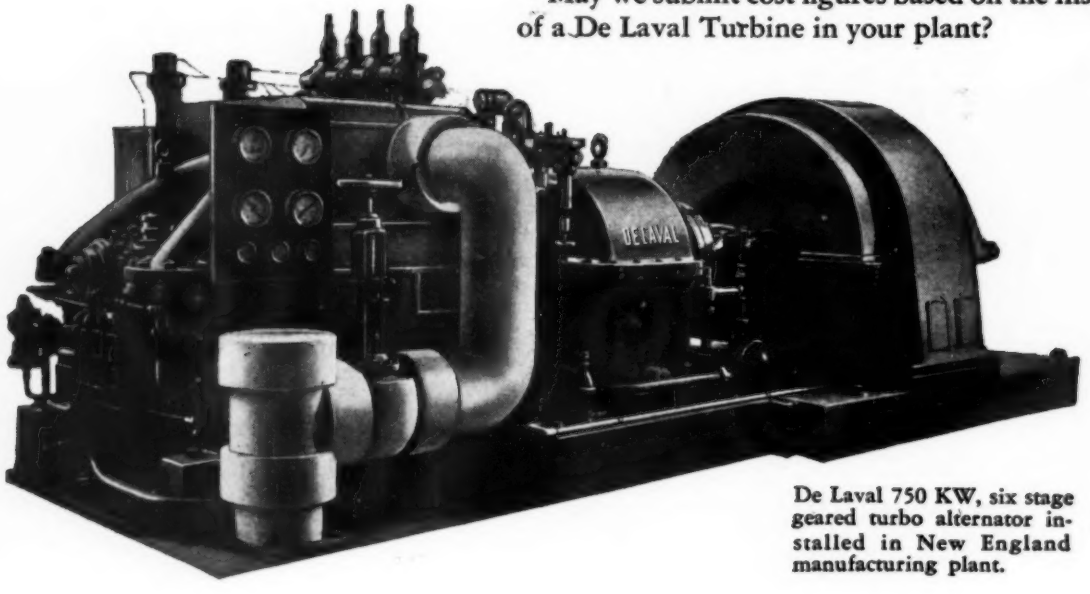

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MARCH 1948 VOLUME 92, NUMBER 3

A CROSS-INDEX OF SUBJECTS FOR THE MONTH

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TURBINES, ENGINES, AUXILIARIES; HYDRO POWER
DIESELS, GAS ENGINES AND ACCESSORIES
AIR CONDITIONING AND REFRIGERATION
ELECTRICAL EQUIPMENT, ELEVATORS
PIPING, VALVES AND SPECIALTIES
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INSTRUMENTS, CONTROLS
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# of inefficient combustion

# of a *Link-Grate* stoker

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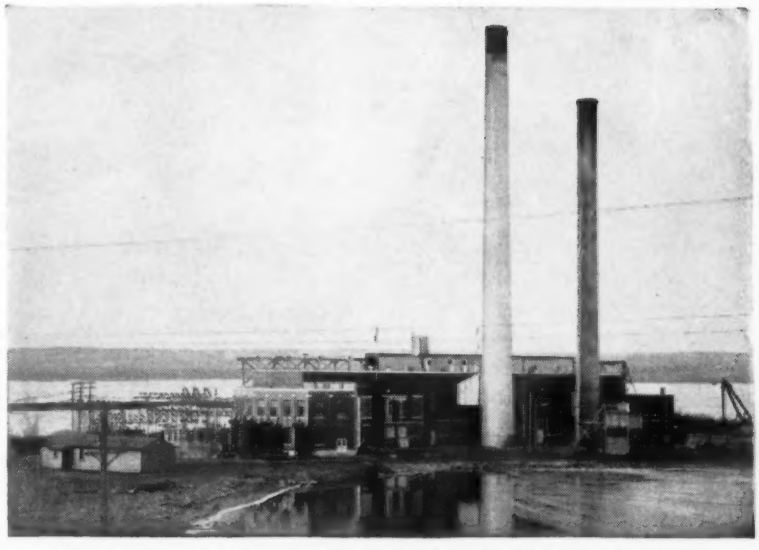
Because of this conveying movement of the Link-Grate, ash comes off the ash discharge plate continuously—doing away with periodic dumping and reducing labor. Clinkers are not a problem.

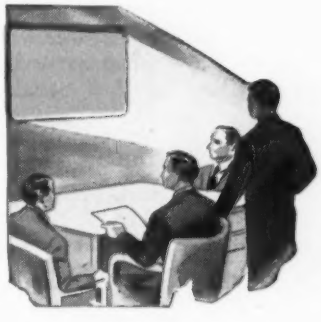
Since the fuel bed is always porous, the Link-Grate Stoker can meet suddenly increased steam demands quickly with full combustion efficiency.

Get the complete information about the Link-Grate before you make an investment in stokers. If possible, see one in operation. Your nearest Westinghouse office will be glad to arrange an appointment with a user. Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa. J-50469



Almost no smoke is coming out of the stacks although the boilers are in operation at this power plant of the Lake Superior District Power Co. at Ashland, Wisconsin. In this installation are two 6-retort, SDL-29 Link-Grate Stokers. (Photograph is not retouched.)

Show Link-Grate Movies in Your Own Office. A 15-minute sound moving picture has been produced to show in detail the operation of a Link-Grate Stoker. Whether you can visit an actual Link-Grate Stoker in operation or not, this interesting 16 mm. film will show you its action and explain its points of superiority while you sit at your desk. To borrow a print of this film for your own private showing, write to Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania.



Westinghouse

PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

Link-Grate STOKERS

In this trench warfare

BYERS WROUGHT IRON PIPE

fights against corrosion

This new underground line connects two wells serving the boiler house at an industrial plant. Hazards to pipe life are particularly severe, as the soil contains cinder fill. The engineers looked for a material with extra corrosion resistance . . . and selected wrought iron. As an added precaution, the pipe was coated and wrapped before installation.

Even with ordinary soils, highly aggressive corrosive attack is frequently encountered, and only the use of the right material can forestall early and extensive repairs and replacements. Wrought iron has been used for so many years, in locations all over the country, that its superior resistance is a matter of engineering record, and recommends it for first consideration. For instance:

. . . a water main made of ordinary material with $\frac{5}{8}$" wall developed 25 leaks within 2,000 feet of length in 42 years. A parallel wrought iron line with $\frac{3}{8}$" wall developed *no* leaks in 61 years.

. . . a 50" wrought iron water main is still operating under 135-lbs. pressure after 60 years service. Only one leak has ever been reported.

. . . In a mid-west community, wrought iron lines were reported as still serving after 43 years. Ordinary materials had lasted only 14 years in the same areas.

Examples could be continued almost indefinitely . . . but these will illustrate the splendid performance of wrought iron.

The reason for wrought iron's corrosion resistance is found in its unique structure. Tiny fibers of glass-like silicate slag, threaded through the body of high-purity iron, halt and "detour" corrosive attack, and so discourage pitting and penetration. The fibers also help to anchor the initial protective scale that shields the underlying metal.

If you have any underground lines in prospect, you will find some helpful information in our bulletin, "Wrought Iron for Underground Services." Ask for a copy.

A. M. Byers Co., Pittsburgh, Pa. Established 1864. Boston, New York, Philadelphia, Washington, Atlanta, Chicago, St. Louis, Houston, Salt Lake City, Seattle, San Francisco. Export Division: New York, N.Y.

CORROSION COSTS YOU MORE THAN WROUGHT IRON

BYERS

GENUINE WROUGHT IRON

TUBULAR AND HOT ROLLED PRODUCTS

ELECTRIC FURNACE QUALITY ALLOY AND STAINLESS STEEL PRODUCTS

POWER

PHILIP W SWAIN, EDITOR • MARCH 1948 • ESTABLISHED IN 1882

WANTED: A PROGRAM

A GRATIFYING PERCENTAGE of central-station turbines now on order are "standards." Their purchasers will benefit by savings in cost and all-important delivery time. Thus the standardization program jointly sponsored by ASME and AIEE begins to pay dividends.

What about the turbines not covered by this program? In particular, what about the units from 500 to 7500 kw, approximately three-quarters of which go into industrial plants to provide process steam as well as electricity? Need for savings in equipment cost is certainly no less in industry than in the utility field.

As L E Newman points out in his thoughtful article on pp 73-75, industrial turbine-generators are built in bewildering variety to meet specialized needs of process-power plants. They can be manufactured with reasonable economy under these adverse conditions only because individual makers have been able to achieve some standardization in their own operations.

The typical unit is a combination of elements, each of which has been standardized to some degree. Yet the number of possible combinations is so great that it proves impossible to build more than a few units from any one set of drawings. It is likewise difficult to manufacture for stock, which would help level out peak and valleys in demand. The net result of these and other conditions is unavoidably higher cost, longer and less reliable delivery schedules and diversion of engineering talent from the prime job of improving products.

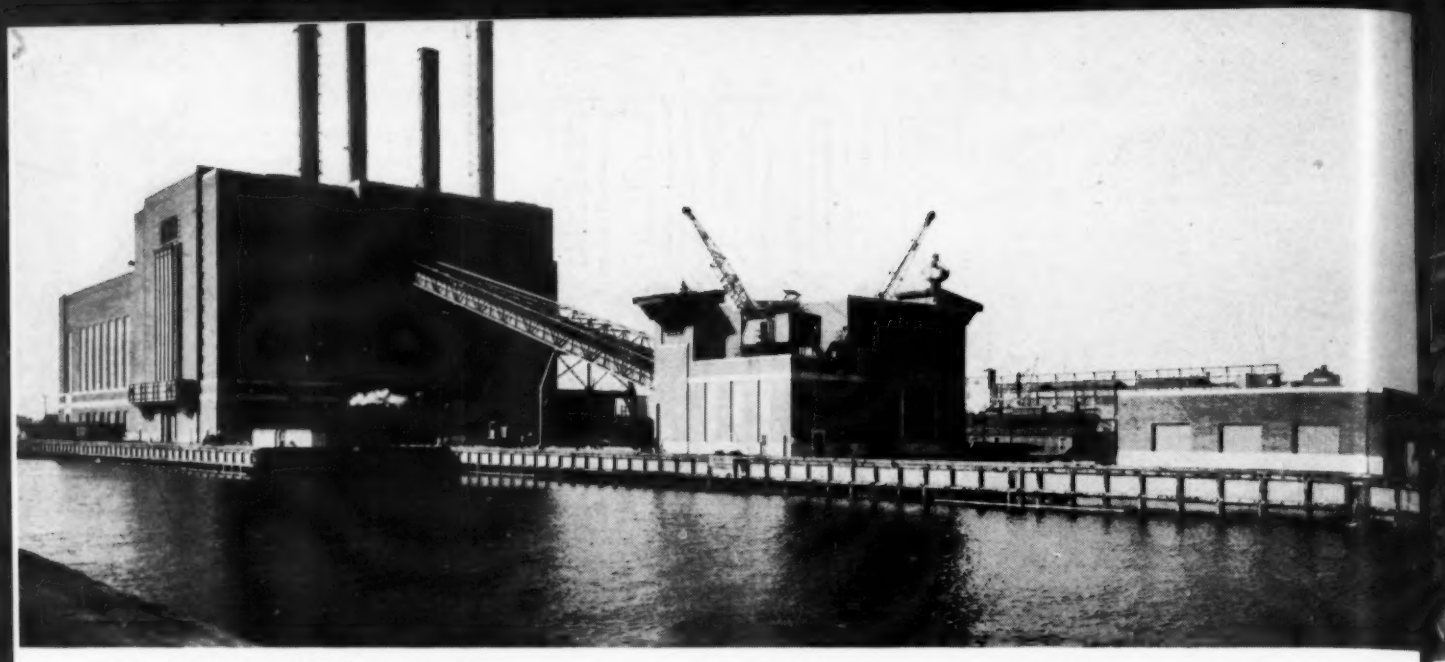
After analyzing the variables, Newman offers concrete proposals that promise to cut the number of possible combinations while still fitting at least half the cases without hardship. This leaves a substantial number of "specials" but it must be remembered that standardization doesn't mean higher-cost specials; it means lower-cost standard units.

Aware that such a program is too ambitious for industry today, the author presents it as a basis for discussion, with the hope that power engineers can agree on some similar set of standards. These would serve to guide equipment selection for new plants, where conditions permit freer choice than in extensions and modernizations. In this way standardization would tend to come about naturally, and each forward step would be tested by experience.

This will not be an easy job. The technical complexities are apparent. Not so apparent, but perhaps more important to success or failure, are the problems imposed by the spread of interests involved. Where is the common meeting ground for engineers of oil refineries and paper mills, chemical plants and steel mills, breweries and metal-working establishments? How can their needs and opinions be canvassed? Most important, who will take the lead in bringing these interests together?

Experience with large-turbine standardization reveals the advantages. Delay only further complicates the problem. Let's tackle it now!

Read and weigh the merits of Newman's proposals; give some thought to ways in which you and your industry can work with other power engineers and industries to arrive at mutually agreeable standards. Let's have your comments and ideas—POWER will gladly serve as your clearinghouse and forum.



SOUTHWARK STATION NOW HOUSES two units representing one half of the projected ultimate development of 600,000 kw. Each stack serves one 850,000-lb-per-hr boiler operating at 925 psig, 900 F. Coal unloading capacity equals 700 t per hr

Use of House Turbines Marks Design of Philadelphia's Southwark Station

This plant features largest main turbines to be currently installed. They are arranged on unit system with two boilers per turbine. Low-pressure boiler feed pump partly raises feed pressure before it flows through all heaters at constant head

By A R PETTIT and F W MYERS, *Philadelphia Electric Co*

▶ THE SOUTHWARK STATION of the Philadelphia Electric Co, in the southeast section of Philadelphia on the Delaware River (2501 South Delaware Ave), has recently been placed in operation. The site, ultimately accommodating four 150,000-kw condensing turbine-generators, has at present only two units. No. 1 went into commercial operation on August 1, 1947, No. 2 will be starting about now.

Main Units. Westinghouse cross-compound double-flow machines are rated at 150,000 kw at 0.8 pf with a 65,000-kw h-p element and a 85,000-kw l-p element. The h-p single-flow 19-stage turbine turns at 3600 rpm, the l-p double-flow 22-stage turbine at 1800 rpm. Generators are totally-enclosed hydrogen-cooled single-winding machines with direct-connected main and pilot exciters. Generation takes place at 13,800 v, 3 phases, and 60 cycles with a 250-v field.

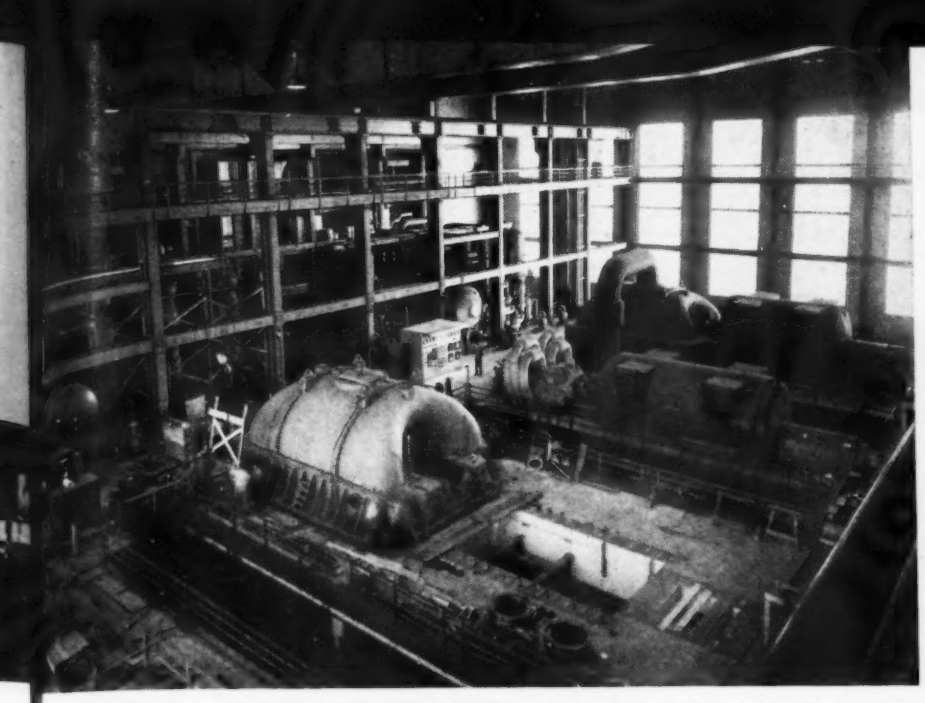
The cross-compound double-flow machine was selected after a study showed it to have the lowest heat rate and the lowest price except for a single-casing machine.

Throttle steam condition of 850 psig, 900 F was selected after cost comparisons with 850 psig—925 F, and 1250 psig—925 F showed that operating cost savings would not be large enough to justify the additional investments. These studies were made in 1940 and construction started in 1941. Because of the war, it was stopped in the summer of 1942 and not resumed until the fall of 1944.

In establishing unit capacity, 150,000 kw was chosen as it was felt that sizes up to that of the existing 165,000-kw machine at Richmond Station were reasonable with a company installed capacity of over 1,200,000 kw and an interconnected regional system capacity of about 5,000,000 kw. The 150,000-kw units made it possible to provide the most generating capacity in the available space.

House Turbines. An independent auxiliary turbine-generator for each main unit will normally supply power for main station auxiliaries. This will provide maximum reliability for auxiliary power by having its source free from outside system disturbances.

Allis-Chalmers units are 12,500 kw, 3600 rpm, noncondensing steam turbines driving 0.8-pf air-cooled generators with main and pilot exciters. The single-flow turbine has one impulse stage and 29 reaction stages and operates with main steam conditions of 850 psig and 900 F at the turbine throttle.



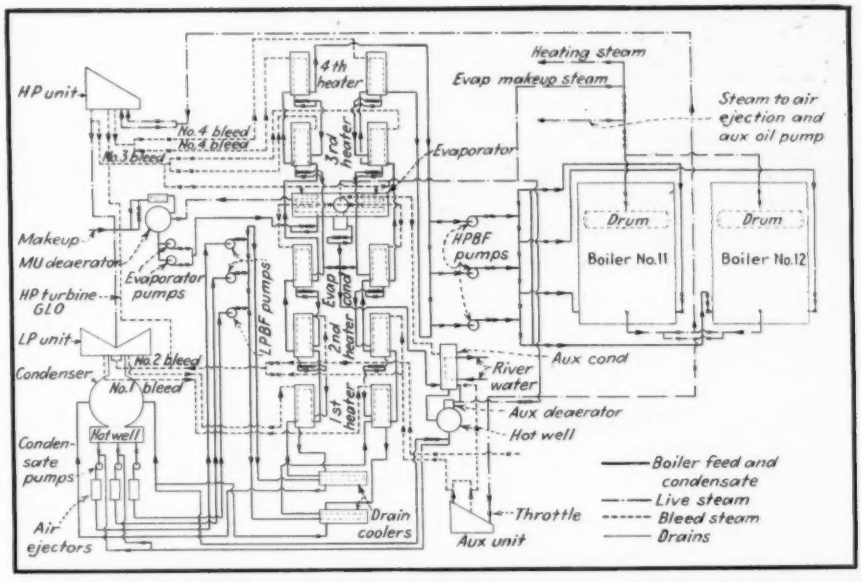
UNIT NO. 1 IN REAR, NOW OPERATING, will be duplicated by Unit No. 2, under construction, in foreground. Feedwater heaters are located beyond the columns

Unit System. This arrangement was chosen for (1) simplicity by omitting ties between units, and (2) reliability by keeping the difficulties of one unit isolated from the others and the elimination of many valves. Unit parts completely separated from the others are main turbine, house turbine, feedwater systems, main steam systems, soot-blower systems, drip systems, draft systems, dust-collector systems, stacks, generator cooling-water systems and circulating-water systems between river and condenser.

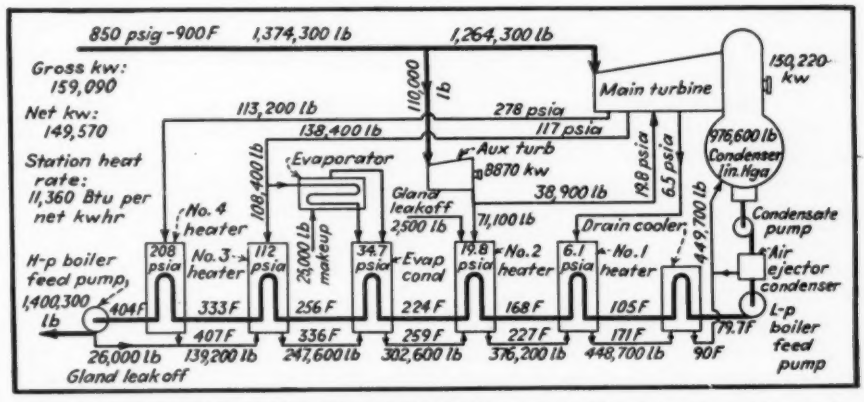
Heat Balance. Diagram below shows the heat balance for a station net output of about 150,000 kw, the most efficient load. The scheme makes best use of bleed steam as set by turbine design for producing feedwater temperatures suitable for the boiler design. The auxiliary turbine exhaust discharges into (1) main unit second feedwater heater and bleed point (2) auxiliary condenser and (3) auxiliary deaerator. Normally, with the main unit operating, the exhaust passes to the second heater bleed lines where it furnishes these heater demands and discharges the excess into the main unit turbine after the 5th stage of the low-pressure element. Induction valves protect this bleed point against steam flow from the auxiliary unit after the main unit has tripped out.

Feedwater System. There are three condensate pumps, three 1-p feed pumps and three h-p feed pumps. Two of each set of units are needed for operation under maximum load. From the condenser, condensate flows through the condensate pumps and 1-p feed pumps. Pressure developed delivers the feedwater through the drain cooler and all heaters to the suction of the h-p feed pump without danger of flashing. The two rows of heaters of each unit have connections between them only at the ends, with no valves between heaters in either row. During trouble in either line of heaters, the whole faulty line is taken out of service by closing the valves at both ends. With only one line of heaters in service a maximum load of about 130,000 kw can be carried on the unit. Valving in the ring loop at the h-p feed pump discharge insures water supply to at least one side of each boiler should trouble develop with any pump or the piping.

Steam Piping System. Main-steam-system valving allows isolating either boiler, the main unit or the house tur-



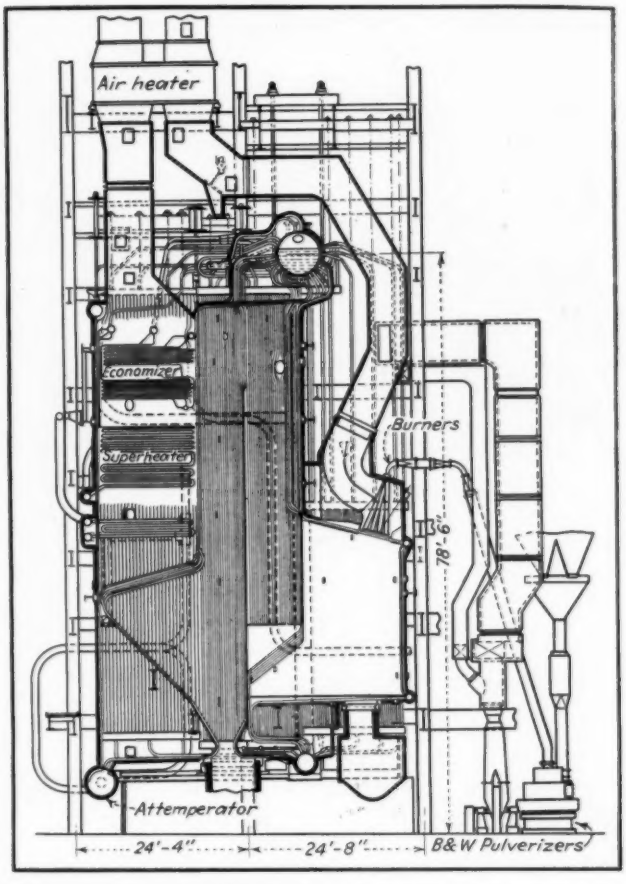
MAIN PIPING DIAGRAM FOR ONE UNIT shows absence of ties with other unit. Parallel feedwater circuits through heaters can be shut off only at feed pumps



AUXILIARY TURBINE EXHAUST DISCHARGES to both No. 2 heater and into the main turbine at 19.8 psia. Note the location of 1-p and h-p boiler feed pumps

FOUR OF THESE STEAM GENERATORS

THOUGH FOUR MILLS SUPPLY these eight burners on boiler No. 12, only three mills are needed to develop rated output



TWO-DRUM OPEN-PASS BOILER fired with pulverized coal has attemperator located in lower drum for superheat control

bine for repairs without disturbing the rest of the unit system. The h-p and l-p elements of the main turbine cannot be operated separately.

Auxiliary steam taken from the boiler drums avoids the need for desuperheating. Pressure reduces to 400 psig for the auxiliary oil pumps and air ejectors, and to 125 psig for the heating-system headers.

Bleed steam comes from two points in each of the h-p and l-p turbines, the lower point on the h-p element being at crossover pressure.

Makeup System. City water supplies the makeup system. Two lines from separate sections of the city mains and a 24,000-gal storage pit insure reasonable reliability. Water is pumped from the pit through zeolite softeners and blow-down heat exchanger into the makeup deaerator. From the deaerator the evaporator pumps deliver the water to the evaporator shell. Normally vapor from the evaporator condenses in the evaporator condensers, in the heater rows between the 2nd and 3rd heaters. Evaporator vapor also supplies the makeup deaerator. With the main unit out of service, auxiliary steam produces evaporation, the vapor condensing in the auxiliary condenser, and the condenser drains pass to the condensate-pump suction.

Cooling-Water System. This system has two parts: (1) supply by the generator cooling-water pumps and (2) supply from the river-water pumps. The former feed the generator coolers and the turbine-oil coolers, and the latter the rest of the system. Rotary strainers, at the pump discharges, strain all cooling water. Using two sets of pumps saves power because of the much lower head requirements on the generator-cooling pumps than on the river-water pumps.

Circulating-Water System. Two 76,000-gpm circulating-water pumps serve each main unit condenser. Each pump, in separate sections of the screening basin at the river front, obtains water through one revolving screen and discharges through a butterfly valve into a 6-ft 6-in. dia precast concrete pipeline delivering water to the condenser. Automatic control opens and closes the butterfly valves with starting and stopping of the pumps.

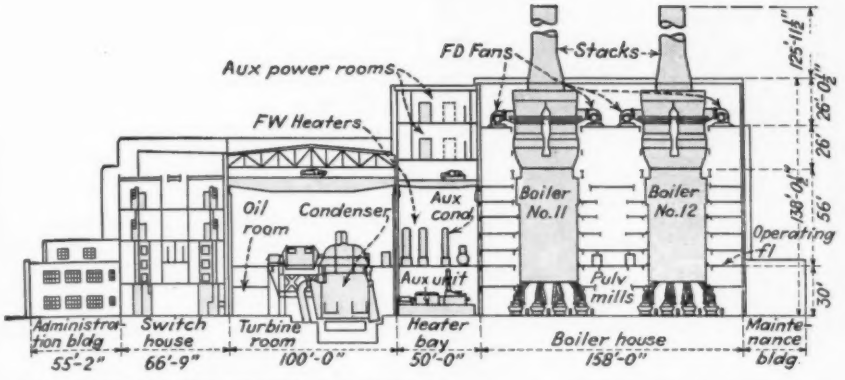
Two pipes, each 6-ft 6-in. dia, were installed instead of one larger pipe because small depth from yard level to pier decking would permit nothing larger. Also, this size is satisfactory for one-pump operation.

An adjustable weir at the condenser discharge prevents breaking the siphon at low tide. Baffling at discharge-tunnel exit dissipates strong currents that might interfere with boat handling in that area.

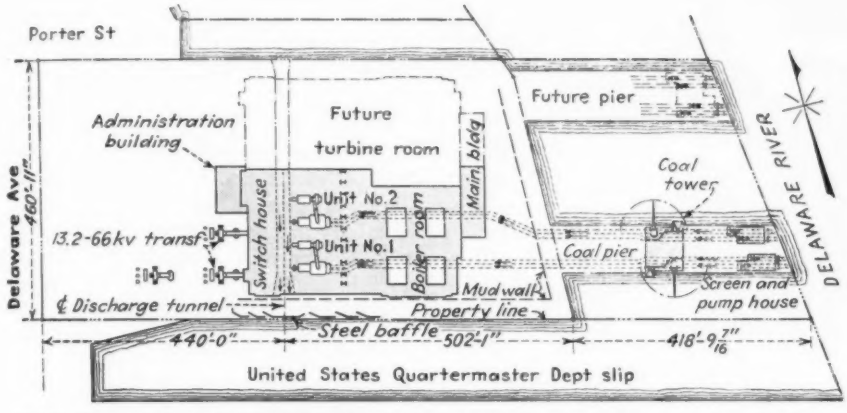
Chlorine, obtained in bulk via railroad tank cars, treats both circulating-water and cooling-water systems at the screening basin.

Condensers. These units are Foster Wheeler, surface type, single pass with deaerating hot wells. They are placed

ARE IN THE INITIAL STATION INSTALLATION



CROSS SECTION THROUGH NO. 1 UNIT shows in-line arrangement of main equipment. Auxiliary turbine-generator on ground floor is underneath the heater bay



PLAN OF STATION LAYOUT SHOWS circulating water intake at end of pier on river and the discharge tunnel at right angles leading into slip next to station

with the tubes paralleling main turbine center lines because of the space needed for pulling tubes. Rupture disks provide atmospheric relief to the free exhaust stack.

Steam Generators. Two Babcock & Wilcox boilers supply each turbine-generator. They are 2-drum open-pass wet-bottom type having a design pressure of 1075 psig and producing steam of 850,000 lb per hr at 925 psig and 900 F continuously. The 3-hr rating is 935,000 lb per hr. Each boiler has a 21,373-sq-ft continuous-tube economizer, a 26,923-sq-ft continuous-tube superheater, a 1125-sq-ft attemperator, two 61,500-sq-ft regenerative-type air heaters and four B&W type E mills. With high-grindability coal three mills will be adequate for the rated steam output of one boiler.

The attemperator, in the lower drum, holds steam temperature to a maximum of 900 F. Steam passing from the first to the second section of the superheater flows through a 3-way valve, which admits the needed amount to the attemperator and bypasses the remainder.

The boiler outer walls are enclosed in full plastic casing, a considerable amount of the insulation being gunited in place.

Provisions have been made for acid washing, and all boilers are being treated before going into service. Tube turbining after completion of the boilers is considered unnecessary.

Retractable soot blowers serve the boiler, and rotary blowers are used on the economizer.

Every boiler has two forced- and two induced-draft fans. Each fan has a hydraulic coupling to provide variable speed. One stack serves each boiler.

A venturi throat at each stack top improves dissipation of gases and prevents down-drag on the leeward side.

Coal Handling. Coal is normally delivered via barge and in emergencies via rail. Speed-o-matic cranes unload it from barges, feed it by apron feeders to Bradford breakers in the coal tower, from here belts transport it to the bunkers, passing over a magnetic separator at the boiler-house entrance. Two complete lines of equipment are each capable of handling 350 tons per hr. One 1000-ton bunker fed by either of the main cross belts serves each boiler. An inverted U-shaped corrugated iron hood covers the inclined belt conveyor. The entire coal system inside the building is encased and the bunkers sealed against dust leakage into the building. For bunker ventilation, air enters through one-way louvers and is drawn out by the induced-draft system.

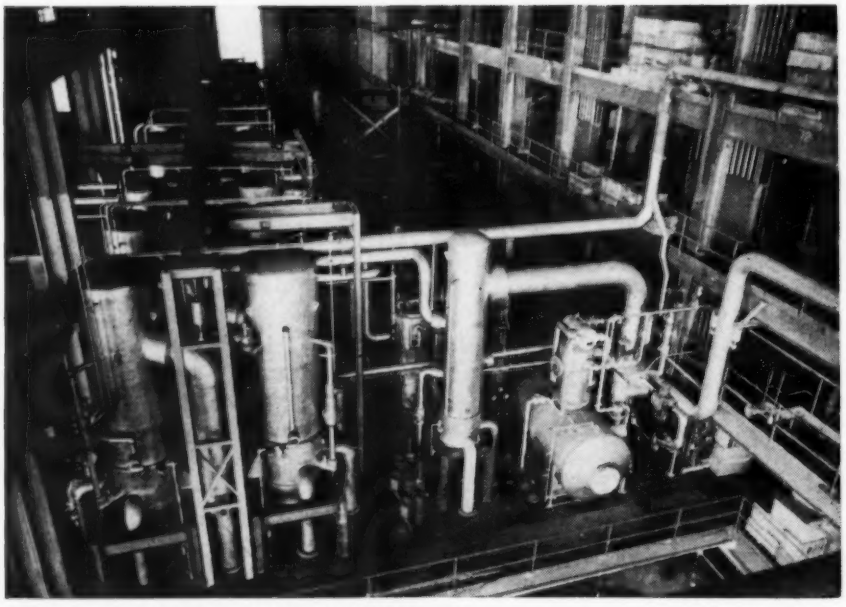
In the emergency handling system, coal can be unloaded from four 70-ton cars simultaneously. It passes from the unloading hoppers by apron feeders, flight conveyors and gravity-discharge elevator and conveyor through a granulator just ahead of the elevator.

A central control panel for the coal-handling system is located on the conveyor floor of the boilerhouse near the transfer chutes at the No. 1 unit bunkers. A private telephone system connects control panel, crane and yardmaster's office.

Ash Handling. A recirculating type of ash-sluice system removes ash from the boilers. Water recirculates from the clearwell at the end of the system. Ash sluices from the boilers, through trenches to the ash pump pit where it passes through clinker grinders before reaching the pumps. The pumps discharge to a pit in the yard from which a locomotive crane removes the ash and the water decants off to the clearwell. Trench liners are mostly of Ashcolite, but in one section granite blocks have been used as lining for experimental purposes.

A multicyclone-type mechanical collector, between air heaters and induced-draft fans, removes flyash. From here a fan transports the ash to drop-out and storage tanks; when finally passing through unloading valves, it is commercially conditioned with water for disposal.

Model Tests. Many model tests and studies determined design and materials. Core borings and chemical tests were made on the soil. Different types of bearing piles were driven and test loaded before preparing specifications. Arrangement of baffles at the discharge tunnel exit, blading for circulating-water pumps, shape of screening basin at circulating-pump suctions, condenser water-box design, arrangement of burners, windbox design, and material for condenser tubes and other tubes coming in contact with river water were



HEATER BAY HOUSES MAJOR EXCHANGERS, l to r, two rows of parallel feedwater heaters, auxiliary condenser front of makeup deaerator, and auxiliary-condenser hotwell in horizontal position with vertical auxiliary deaerator mounted above

determined by studies on models.

Main Electrical Facilities. Southwark Station connects through a 13.2-kv ring bus both to the 66-kv bulk-power transmission and 13.2-kv distribution systems. Each of three 100,000-kva forced-oil-cooled 3-phase transformers ties directly to a 66-kv cable. Mulsifyre thermostatically controlled, permanently-piped water-spray systems protect the transformers from fire.

Electrical equipment for the 13.2-kv main power busses and circuits consists of metal-enclosed prefabricated units, selected to provide safe reliable operation and improved cleanliness. This equipment, of phase-isolated construction, probably reduces inspection and cleaning operations to a minimum. Oil use in the switch house has been avoided by air-blast circuit breakers.

Equipment for 13.2-kv busses and circuits has been segregated on each floor by brick walls to furnish separate rooms for each of the four bus sections and thereby confine damage in electrical failure.

Switchboards in the electrical control room are the enclosed cabinet type with instruments and controls on vertical steel panels. Each of the main source and auxiliary power boards has a mimic bus. Instruments have new scales developed to minimize shadow, and have glare-proof glass. The air-conditioned control room has an acoustic ceiling and cold-cathode lighting fixtures, giving 15 foot-candles on the switchboard and 25 foot-candles on the operator's desk.

Auxiliary Supply. Auxiliary power supply has two sources (1) auxiliary turbine-generators and (2) station service transformers supplied from the 13.2-kv ring bus. As shown on p 98, one 12,500-kw 4160-v turbine-generator supplies the two 4-kv auxiliary power busses; each is the power source for the motors of one of the two boilers for a main generator and for half the auxiliaries of a main turbine-generator.

The 10,000-kva station service transformers supply the two 4-kv station service busses. These serve the less essential auxiliaries and through ties to the auxiliary power busses are the source for the essential auxiliaries both if main unit is starting and if an auxiliary unit is out of service.

The 4-kv busses supply the 200-hp motors and larger, while the 440-v busses feed the smaller motors. The 440-v motors are supplied from the auxiliary power and station service 4-kv busses by unit-type substations. Eight of these have 750-kva transformers, and two have 500-kva units, at centers of load throughout the plant.

Four unit-substation type equipments, having voltage regulators, supply power for plant lighting.

All auxiliary-power-supply equip-

(*Continued on page* 98)

PRINCIPAL POWER-PLANT EQUIPMENT

Southwark Station, Philadelphia Electric Co, Units 1 and 2

TURBINE-GENERATORS:

Main turbine-generators, 2.....Westinghouse Electric Corp
150,000 kw; h-p element: 65,000-kw single-flow 3600-rpm; l-p element: 85,000-kw double-flow 1800-rpm; 850-psi 900-F throttle steam; maximum steam values at crossover, 145-psi 520-F; two bleed points per element. Rated at 0.8-pf 13,800-v 3-phase 60-cycle hydrogen-cooled at 0.5 psig. Direct-connected main and pilot exciters

Auxiliary turbine-generators, 2.....Allis-Chalmers Manufacturing Co
12,500 kw at 0.8 pf, 4000-v 3-phase 60-cycle 3600-rpm, air cooled, 850-psi 900-F throttle steam, 5- to 35-psi backpressure

Main condensers, 2.....Foster Wheeler Corp
79,000 sq ft, surface type, single pass, undivided water box, Muntz metal tube sheets

Auxiliary condensers, 2.....American Locomotive Co
1160 sq ft, surface type, single pass

Main air ejectors, 3 per unit.....Foster Wheeler Corp
Twin element, 2 stage, steam jet, 240-sq-ft intercondenser, 104-sq-ft aftercondenser, 400-psi saturated steam

Priming ejectors, 2.....Foster Wheeler Corp
Single stage, 3340 lb steam per hr at 400 psi

Oil purifiers: 4-500 gph for main units, 2-200 gph for auxiliary units } .....De Laval Separator Co

Condenser and heater tubes.....Phelps Dodge Copper Products Corp
Condensers: Admiralty B; No. 4 heaters: 80-20 cupro-nickel; other heaters: Admiralty A

Condenser hotwell level control.....Bailey Meter Co

FEEDWATER HEATERS:

Heat exchangers, 2 sets per unit.....American Locomotive Co
Drain cooler, 1st, 2nd, evaporator condensers, 3rd and 4th heaters. All vertical except drain coolers

Evaporators, 1 per unit.....Westinghouse Electric Corp
1020 sq ft, horizontal, submerged bundle, thermal descaling, arsenical copper tubes, steel tube sheets. 40,000 lb per hr evaporated with 65-F MTD, 4500-lb-per-hr blowdown

Makeup deaerator, 1 per unit.....Cochrane Corp
Preheater type, 40,000-lb-per-hr capacity

Auxiliary deaerator, 1 per unit, 20,000 lb per hr.....Cochrane Corp

STEAM-GENERATING EQUIPMENT:

Boiler, superheater and economizers, 4....The Babcock & Wilcox Co
2 drum, open pass, continuous slag tap, pulverized-coal fired. Continuous output 850,000 lb per hr at 925 psig and 900 F; 935,000 lb

per hr for 3 hr. Design pressure, 1075 psig. Surfaces: boiler, 20,715 sq ft; superheater, 26,923 sq ft; economizer. 21,373 sq ft

Air preheaters, 2 per boiler.....The Air Preheater Corp
Regenerative type, 61,500 sq ft

Pulverizers, 4 per boiler.....The Babcock & Wilcox Co
25,800 lb per hr with 80% through 200 USS screen and 80 grindability coal, moisture up to 8%. 200-hp motor drives

Forced-draft fans, 2 per boiler.....American Blower Corp
137,500 cfm, 1153 rpm, 400-hp motors, hydraulic couplings

Induced-draft fans, 2 per boiler.....American Blower Corp
250,000 cfm, 845 rpm, 1500-hp motors, hydraulic couplings

Combustion-control system (electric).....Leeds & Northrup Co
3-element level control (air system).....Bailey Meter Co
Water columns, 2 per boiler.....Diamond Power Specialty Corp
Soot blowers.....Vulcan Soot Blower Corp
8 retractable and 4 rotary per boiler

Mechanical dust collectors, 1 per boiler.....American Blower Corp
Flyash unloaders, 1 per boiler.....United Conveyor Corp
Rotary dustless type, 1175 cu ft per hr

Stacks, ducts, breeching, 1 per boiler.....Connery Construction Co
Gunite lining for stacks.....Latimer Construction Co
Raw-coal hoppers and pipes.....Connery Construction Co
Ash-handling system .....The Allen-Sherman-Hoff Co
Ash and slag hoppers for each boiler, sluicing nozzles, trench liners, clinker grinder, 2 ash pumps, 2 recirculating pumps, piping to yard pit, decanting lines

Coal scales, 4 (on one boiler only).....Stock Engineering Co
Coal bunkers, 1 per boiler, 1000 tons each.....American Bridge Co
Main coal-handling system.....Link-Belt Co
Two 20,000-lb barge shifters, two 350-ton per hr speed-o-matic cranes, two 42-in. apron feeders, two Bradford breakers, two 36-in. main belt conveyors of 350 ton per hr capacity, two 48-in. magnetic belt conveyors and separators, two weigh belt conveyors and weightometers, four 36-in. bunker conveyors, two 36-in. cross conveyors

Emergency coal-handling system.....Link-Belt Co
Eight 40-80 ton per hr, 36-in. apron feeders, one 350-ton-per-hr 48-in. flight conveyor, 1 granulator (1½-in. product), one 350-ton-per-hr elevator and conveyor with 28x48-in. buckets

PUMPS:

Circulating-water units, 4.....Allis-Chalmers Manufacturing Co
76,000 gpm, 25-ft total head, 600-hp motor drive

Condensate, 6 .....Ingersoll-Rand Co
2200 gpm, 130-ft total head, 125-hp motor drive

L-p boiler feed, 6.....Ingersoll-Rand Co
2000 gpm, 1270-ft total head, 900-hp motor drive

H-p boiler feed, 6.....Ingersoll-Rand Co
2400-gpm, 2150-ft total head, 1500-hp motor drive

River water, 3.....Layne-New York, Inc
4000 gpm, 250-ft total head, 300-hp motor drive

Generator cooling-water, 4.....Ingersoll-Rand Co
5000 gpm, 130-ft total head, 200-hp motor drive

Makeup, 2.....Worthington Pump & Machinery Corp
150 gpm, 300-ft total head, 20-hp motor drive

Evaporator system, 2.....Goulds Pumps, Inc
180 gpm, 75-ft total head, 5-hp motor drive

Boiler filling, 2.....Ingersoll-Rand Co
1000 gpm, 150-ft total head, 50-hp motor drive

Gland seal, 2.....Goulds Pumps, Inc
350 gpm, 125-ft total head, 15-hp motor drives

City water, 2.....Ingersoll-Rand Co
250 gpm, 200-ft total head, 25-hp motor drives

Fire, 2 .....Layne-New York, Inc
3000 gpm, 210-ft total head, 200-hp motor drives

Fuel oil (ignition), 2.....Worthington Pump & Machinery Corp
26.5 gpm, 300 psig, 7½-hp motor drive

Brine, 2 .....O'Brien Machinery Co (Deming)
20 gpm, 50-ft total head, 1-hp motor drive

Chemical feed, phosphate, 2.....Milton Roy Pumps
46 gph, 1100 psig, 2-hp motor drive

Chemical feed, sulphite and caustic, 3.....Milton Roy Pumps
3 gph, 60 psig, 1/3-hp motor drive

Drip (for auxiliary units), 4..... .....Goulds Pumps, Inc
20 gpm, 80-ft total head, 1½-hp motor drive

Sump, 17 .....Goulds Pumps, Inc
50 to 500 gpm, 10- to 25-ft total head, 1- to 5-hp motor drives

Vacuum heating, two 10,000 sq ft EDR.....Nash Engineering Co
Sewage ejectors, 2.....Chicago Pump Co
1 duplex, 50 gpm, 30-ft total head, 3-hp motor drive. 1 duplex, 200 gpm, 44-ft total head, 5-hp motor drive

PIPING:

Concrete circulating-water, 78-in. ID.....Lock Joint Pipe Co
Steel circulating-water .....Tippett & Wood
Free exhaust and stack.....Tippett & Wood
Low and intermediate pressure.....Grinnell Co, Inc
High pressure .....M W Kellogg Co
Plumbing and fire lines.....D J Keating Co

VALVES:

Butterfly, four 54-in. .....Baldwin Locomotive Works
Nonreturn, four 16-in. .....Schutte & Koerting Co
Large steel gate and globe..... Crane Co; American Chain & Cable Co.; Reading-Pratt & Cady Division
Large steel checks.....Melrath Supply & Gasket Co (Powell)
Tilting disk checks, four 16-in. ...Chapman Valve Manufacturing Co
Cast iron ..... Chapman Valve Manufacturing Co; Crane Co; American Chain & Cable Co. Reading-Pratt & Cady Division
Atmospheric relief for auxiliary unit, 2, multiport....Cochrane Corp
Atmospheric relief for main unit, 4, rupture disk.....M L Bayard Co
Pressure reducing .....Republic Flow Meters Co
Blowoff .....Yarnall-Waring Co
Boiler safety .....Manning, Maxwell & Moore, Inc (Consolidated)
Float-controlled valves and switches.....Hanlon-Waters, Inc (heater drains)

INSTRUMENTS:

Pressure gages, indicating ..... Hajoca Corp, (U. S. Gauge); Manning, Maxwell & Moore, Inc (Ashcroft)
Draft gages .....Republic Flow Meters Co
Tide gage, screen differential alarm.....Moore Products Co
Barometer, Indicating thermometers .....Precision Instrument Mfg Co
Pressure recorders.....C J Tagliabue Manufacturing Co
Pressure and temperature recorders.....Bristol Co
Liquid-level indicators, oil-storage tanks.....Sheffler-Gross Co
Potentiometer pyrometers, Level recorders ....Brown Instrument Co
Mill temperature recorders; Conductivity recorders; CO_2 recorders; Temperature recorders for hydrogen, bearing oil; Boiler-temperature recorders; Portable potentiometers .....Leeds & Northrup Co
Flowmeters, Oxygen recorders .....Bailey Meter Co

ELECTRICAL EQUIPMENT:

13.2-kv switchgear including main bus.....General Electric Co
13.2-kv reactors.....General Electric Co
13.2-kv metal-enclosed leads..... Railway & Industrial Engrg Co; ITE Circuit Breaker Co
13.2-kv termination compartments with test and transfer bus ..... Railway & Industrial Engrg Co
100,000-kva 66-13.2-kv transformers.....Westinghouse Electric Corp
4-kv metal-enclosed auxiliary generator leads..TE Circuit Breaker Co
4-kv metalclad switchgear.....General Electric Co
Unit-type substations, 4000-440 v.....General Electric Co
Unit-type substations, 4000-250 v.....ITE Circuit Breaker Co

MISCELLANEOUS:

Ventilating fans ..... American Blower Corp; Buffalo Forge Co; Ilg Electric Ventilating Co; B F Sturtevant Co
Rotary strainers .....Elliott Co
River-water, 2, 2000 gpm; hydrogen cooling-water, 2, 5500 gpm

Water softeners, 2.....Hungerford & Terry, Inc
1040 KG hardness (2 units), 260 gpm with 2 units

Desliming system .....Wallace & Tiernan Co
6 semiautomatic control, solution feed vacuum chlorinators, 6000 lb per 24 hr each, fed by six 6000-lb-per-24 hr electrically heated evaporators

Revolving screens, intake water, 4.....Link-Belt Co
80,000 gpm at 2.33 fps (clean with low-water level) 1.5-hp motor, 220-gpm spray water

Rubber-expansion joints .....U. S. Rubber Co
Mulsifyre system .....Grinnell Co, Inc
Insulation .....Keasbey & Mattison Co
Air compressors, 2..... .....Ingersoll-Rand Co
895 cfm, 100 psi, 175 hp, water cooled

Air compressors, 2.....Worthington Pump & Machinery Corp
75 cfm, 80 psi, 15 hp, air cooled

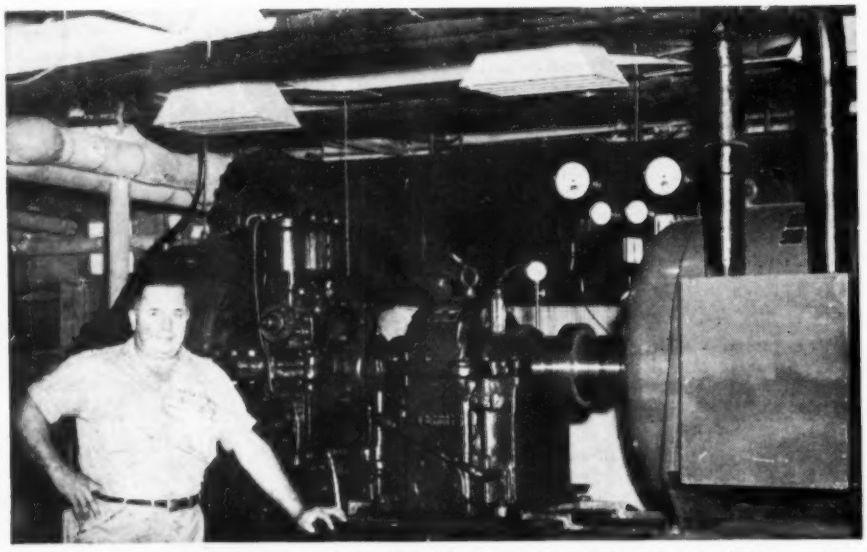
Aftercooler for air compressors....Maleson Co (R P Adams Co, Inc)
Steel tanks.....Connery Construction Co
River water, condensate storage, flyash, oil pump, transil oil storage fuel oil, compressed air, auxiliary condenser hotwell

Steel tanks .....Cruse-Kemper Co
City water, turbine-oil storage, chemical

Blowoff tank .....Tippett & Wood
Traveling cranes, 3.....Manning, Maxwell & Moore, Inc (Shaw-Box)
110-115 ton, 100-ft span 70-ft lift; 50-10 ton, 50-ft span 70-ft lift; 5 ton, 25-ft span

Elevators, 2, 3500-lb cap, 250 fpm.....Westinghouse Electric Corp
Elevator, 2000-lb cap, 50 fpm.....Otis Elevator Co
Diesel-electric locomotive, 45 ton..... ....General Electric Co
Structural steel.....American Bridge Co
Miscellaneous builders iron.....Frederick Grundy Iron Works, Inc
Brickwork, cut stone and glass block.....John B Kelly, Inc
Wharf construction .....Thomas Earle & Sons, Co
Cofferdam for screening basin.....J. E. Brenneman Co
Floor Grating ..... Blaw-Knox Co; W A Laub Co
Louvers, dampers and operators..... .....Airolite Co
Precast concrete plank (turbine-room roof).....Concrete Plank Co
Concrete-filled piles.....Raymond Concrete Pile Co
Yard tracks .....Bethlehem Steel Co

Skillful Planning Licks Problems Of Air-Conditioning Installation



1 Refrigerating compressor located in the basement chills the circulating water, which is pumped for distribution to the attic space above the thirteenth floor

Fitting equipment into this occupied structure meant more than just connecting the various parts. The job had to be done with a minimum of noise, and the engineers had to come up with the answer to, "Where do we put the cooling tower?"

► A YEAR-ROUND air-conditioning system, which services 400 guest rooms of the Ansley Hotel, Atlanta, Ga., presented unusual installation problems associated with structural work on an occupied building.

The job was complicated because the main structure was built in 1913 and an annex added in 1923. Also, work had to be planned for minimum interference with business, as a hotel cannot completely close its doors.

Cooling Tower. Location of the cooling tower was a problem. Physical changes to the building after erection prevented placing the heavy tower on the roof. Answer was to erect a structural-steel framework on rock foundation at subbasement level and build it high enough to clear the elevator penthouse. This amounted to a one-room 15-story "skyscraper."

Refrigerating equipment was bulky and as the machine room was two floors below street level, special provision had to be made for lowering the machinery into place. Space was not available to bring it into the building at street level and lower it down the stairs, so the only alternative was to dig a pit through the sidewalk to subbasement level. The pit was 20 ft long, 25 ft deep and 5 ft wide. Additional width would have made the rigging job much easier, but a district steam main, and nearby telephone cables interfered. The extreme length was required because we could remove the subbasement wall only between two columns, which were on 12-ft centers. The chilling and condensing units were canted in the pit to pass between the columns.

Water Circuit. General scheme for distributing the water is to heat or chill it in the subbasement machine room and then pump it to an attic space above the thirteenth floor. From there it is distributed to downfeed risers for individual room units and to the central-station air system. A return line on the second-floor ceiling collects the water and carries it to the basement in a closed circulating system.

The central station for supplying air is on the thirteenth floor with its distributing conduit in the attic space above. Air goes to the individual room units through conduit located in the same space with the water supply and return lines.

This vertical distribution system, while easy to install in a new building, presents certain problems in the remodeling of an occupied structure, especially a hotel. For instance, in an office building work can be done at night with occupancy continuing throughout normal working hours. A hotel, however, is normally occupied 24 hours a day, which necessitates removing a room from service and completing all work before it is considered ready for occupancy.

Room Grouping. In the Ansley Hotel each vertical set of risers serves a minimum of ten rooms. Careful investigation showed that, to keep the required demolition, installation and redecoration moving at the most economical speed, it would be necessary to have a minimum of five "stacks," or 50 rooms, out of service at the same time. Where a set of risers serves more than one stack, additional rooms were, of course, required.

Cutting Floor Holes. As the hotel is of reinforced-concrete construction, cutting floor holes for conduit risers is a noisy job at best. We first tried an oxyacetylene flame, hoping that the concrete might be calcined sufficiently to allow cutting a hole of the desired circumference. This did not prove successful. Next, we used carbide-tipped drills. Holes, ¾ in. in diameter, were drilled around the circumference and the center knocked out. This method was only partly successful and the high amount of drill breakage made it uneconomical. Accordingly, it was abandoned. After two attempts the majority of

By FRANK A KETTERSON
Mechanical Engineer
Stevens & Wilkinson, Inc.

holes for pipe runs were cut with ordinary drills and hammers.

Component parts of the system are:

1. High-induction type unit designed for installation in each air-conditioned room and for under-window air distribution.

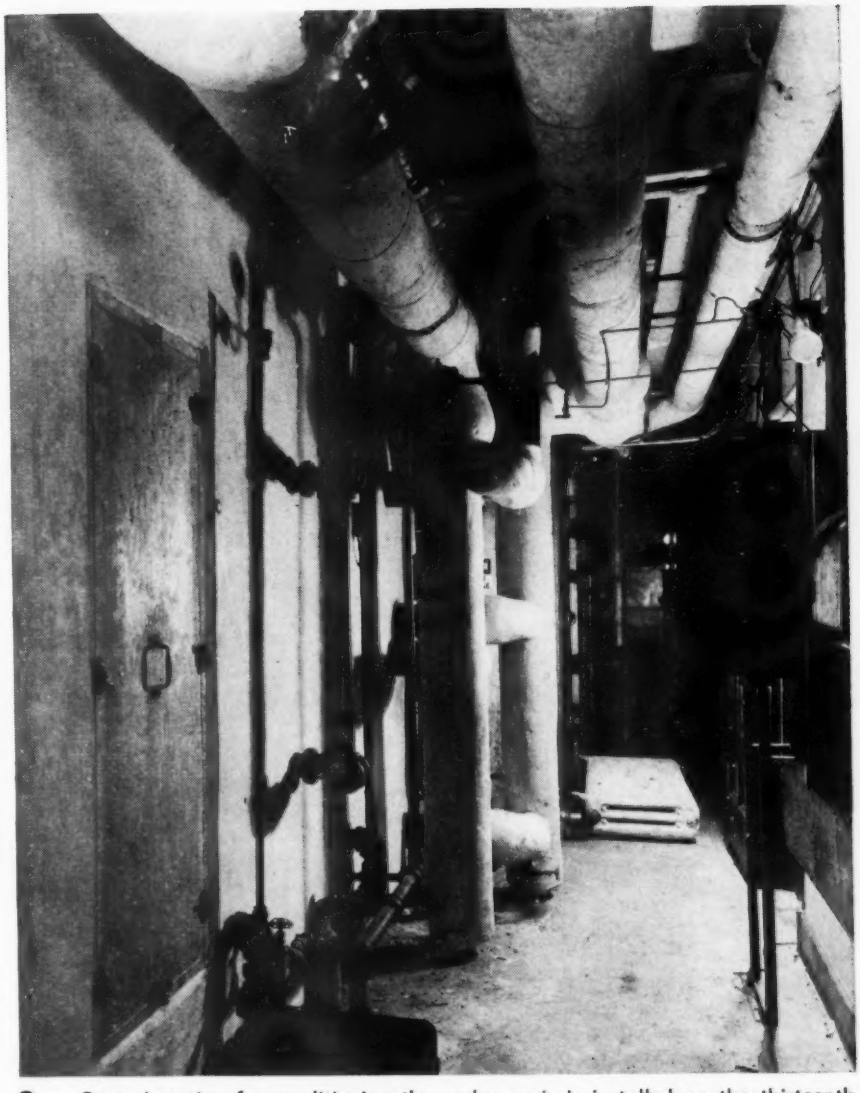
2. Conduit air-distribution system and air-handling accessories consisting of central-station conditioning equipment and necessary conduit.

3. Circulating water pipes, zone assemblies and controls.

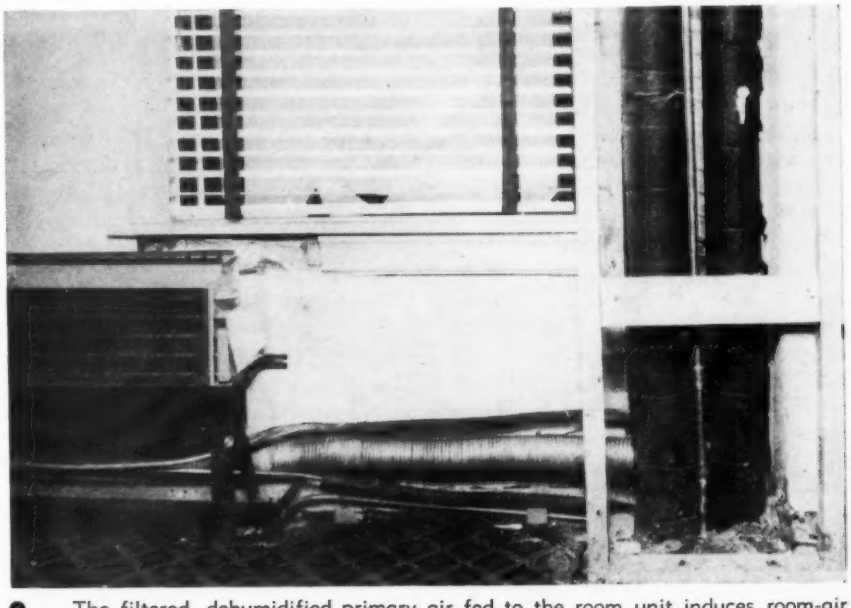
Room Units. Under-the-window units consist of a mixing stack where primary air (outside air) from a central filtering and dehumidifying source is mixed with induced (secondary air) drawn from the room over a platefin coil in the unit. Temperature of the water supplied to individual units is controlled at a remote source in accordance with zone requirements. A special device, which the room occupant can adjust, controls water flow to individual units.

The system includes a specially designed sound-absorbing plenum chamber, which reduces air noise generated in the risers to an acceptable level. Other essential parts are a regular drip-pan-and-gutter assembly to collect condensate, which might occur under abnormal conditions, and an emergency drip pan to collect condensation forming on the return bends, control assembly, or small leaks in connections.

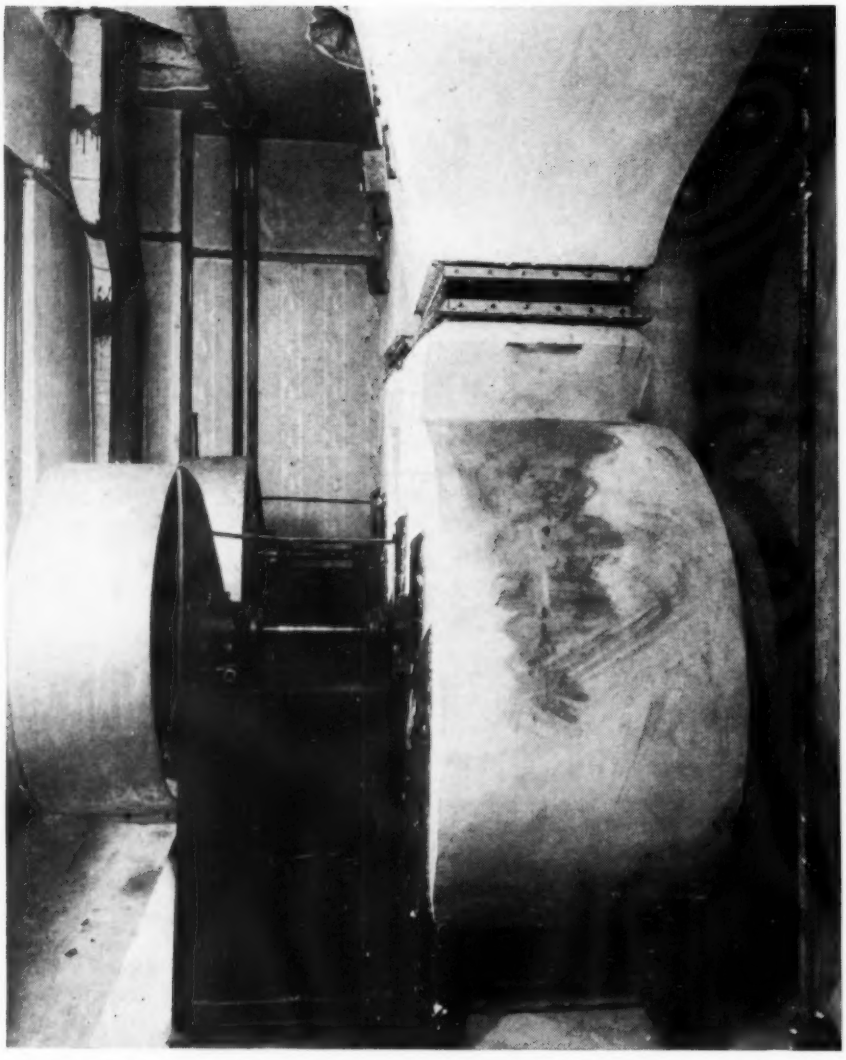
Induced Circulation. An adjusting valve assures obtaining proper nozzle pressure to induce the desired air circulation. It can be used for shutoff purposes if the unit is not in operation. Another feature is the nozzles that regulate air-flow induction ratio of about five to one. This means that, for each cubic foot of air discharged by the nozzle, four cubic feet are drawn from the room into the unit by induction. Thus it is possible to do practically all cooling and heating with only one air stream while primary air from the central station fulfills the ventilating requirements and maintains proper humidity conditions. This separation of the functions of temperature and humidity controls makes it possible to



2 Central station for conditioning the makeup air is installed on the thirteenth floor so that the attic space above can be used for the distribution headers



3 The filtered, dehumidified primary air fed to the room unit induces room-air circulation over a cooling or heating coil in the circulating-water circuit



4 These fans mounted on spring-supported concrete slabs supply ventilating-air requirements. Sound absorbers in duct reduce fan noise to an acceptable level

maintain comfortable conditions when the cooling requirement is small. Primary-air supply is constant for each room, consequently there is uniform air movement in the conditioned space. and constant quantity of outside filtered air for ventilation.

Supply-water temperature for each zone is varied with seasonal demand by room temperature control while room temperature is controlled by varying the quantity of water to the coil of each room unit. Rooms are equipped with control valves, which permit varying the temperature at will without affecting conditions in adjacent areas. The unit serves for both heating and cooling as weather conditions dictate.

The variables of sunheat and outside air temperature account for a large proportion of the heating, or cooling, load in the Ansley. It is, therefore, advisable to control water temperature with an outside thermostat. The instrument has an air-temperature element, while the other part is sensitive to solar radiation. It is this outside pilot thermostat that determines the temperature of water supplied to room units throughout the year, so they have sufficient heating or cooling capacity to fulfill all requirements.

Air Distribution. The central station supplying air to the units is on the top floor. It is smaller than that used with most conventional central stations because it handles only that quantity of outside air required for ventilation. This amounts to about 26,000 cfm which is equivalent to 50 cfm per person.

Apparatus casing between dehumidifier and fan is of welded construction to eliminate inward leakage. Outside dampers are pneumatically and electrically interlocked with the fan so it is impossible to operate the fans unless outside dampers are open.

Controls for the primary air-conditioning apparatus consist of (1) dewpoint thermostat controlling the preheater (2) fan-discharge thermostat controlling the reheater (3) protective thermostat in the outside-air intake. Dewpoint, however, is compensated by a dry-bulb thermostat to maintain proper humidity conditions with varying inside temperatures and also to prevent condensation on windows in winter.

Air Supply. Equipment that supplies the entire guest space with ventilating air includes two relatively high-speed fans mounted on separate spring-supported concrete slabs. At the discharge of each fan is a sound-absorber section that reduces fan noise to an acceptable level.

Air-distribution system consists of insulated round galvanized sheetmetal headers that feed the various risers, which extend downward along the wall of the building. These conduits distribute primary air to the various floors where, at each level, air is taken off through flexible metal tubing and introduced to individual room units. The maximum diameter of risers for this 14-story building is 8 in.

Water Piping. Horizontal branch supply- and return-water connections to each room unit are arranged to take care of expansion in the water riser. Indirect supply and reverse return-water lines assure as uniform a pressure drop as possible across each control valve and unit. The slight additional cost of piping for this arrangement has been more than justified by the saving in time to balance the water flow properly. Water-circulating systems are divided into groups or zones according to exposures.

An outside pilot thermostat controls temperature of the supply water in each zone, as previously stated. During the critical intermediate seasons, this device varies the water temperature through a wide range dependent, of course, on the sun load and outdoor temperature at that particular exposure. Each zone has a separate water-circulating system, with its own pump, strainer, heat exchanger, and complete set of controls to maintain the desired water temperature. Controls are so arranged that each zone becomes an isolated water-circulating system when hot water is being supplied to that zone. This precaution is necessary to avoid the possibility of hot water entering the cooler of the refrigerating machine.

Standardization of Industrial Steam Turbines Is Coming

By following a simplified design pattern for new generating stations a start can be made even though standardization of industrial-type turbine-generator units is not yet possible

By L E NEWMAN, *Assistant Manager,*
Lynn Turbine and Gear Sales Division, General Electric Co

▶ IMPOSSIBLE YET INEVITABLE appears to be the status of industrial steam turbine-generator standardization today. Just as radar, jet propulsion and the atomic bomb seemed impossible ten years ago, so does industrial steam-turbine standardization today. But just as these impossibilities of yesterday are realities today, so will standardization come tomorrow to this highly specialized field of turbines.

It is the purpose of this article to suggest the benefits that may arise from standardization of these industrial steam turbines, to recommend a starting program towards such standardization, to see how this program is influenced by experience over the past 15 years, and to discuss the obstacles that lie in the path of such a program.

By the term "industrial" turbines is meant all steam turbine-generator units built in the range of ratings from 500 to 7500 kw inclusive for industrial and utility use. Three-quarters of this nation's production of turbines in this range of ratings are used by industrials, and most of these turbines supply steam for process in addition to electric power*. These turbines represent 15 to 25% of the value of the powerhouse, but normally are purchased first and must be standardized first if other elements of the powerhouse are to be standardized.

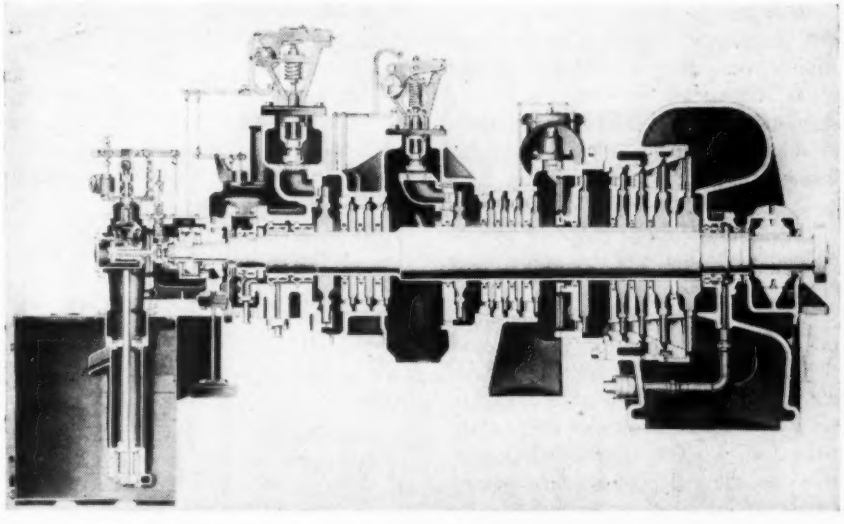
Standardization in a field such as this does not mean mass production. Standardization of automobiles has meant the making of thousands of identical pieces each day; it has meant tools for purposes so specialized that an operation consisting simply of drilling a one-inch hole through a half-inch of steel is done by a machine tool that performs no other drilling operation within the life of the tool. No such mass production can be looked for in a field such as the manufacture of steam turbines where not more than a few dozen duplicates are hoped for within a single year. Tools in this industry are typified by 8-ft boring mills that must be reset for each of a number of operations. What then are the possible gains?

Benefits From Standardization. Standardization permits repetitive manufacture. It releases engineering talent from spending most of its time recombining a multiplicity of parts to devoting its effort to improving the product. It permits final drawings to be available at the time of purchase. It acts to shorten the production time, and to give added surety to a shipment estimate. It permits, to a greater extent, standardization of all related power-generating equipment. Most important, it reduces the capital investment required in a power plant.

The turbine business is a "feast and famine" business to an extent equaled by few other enterprises. In times of prosperity, all turbine manufacturers operate at capacity, yet they cannot satisfy the insistent demands for turbines. In times of depression, each of several manufacturers would be able to meet all the nation's need for turbines and still would be operating below capacity. Standardization would offer to this industry a better load factor—it would permit a buyer to do advance buying with greater assurance that the item would not be outmoded—it would permit the manufacturer to build for stock and thus keep together the highly skilled forces that are necessary to build this complex equipment.

A Start Toward Standardization. The left-hand column of page 75 gives an idea of the complexity of the problem of standardizing steam turbines and their generators. Any move in the di-

* "Extraction Turbines for Industrial Power," by L E Newman, *1946 Proceedings of Midwest Power Conference*, Vol 8, pp 255-9.



1 Proposed standard would specify double-automatic-extraction turbines of this type for maximum size; would be available in the smaller ratings on special order where desired

rection of standardization must take into account the basic fact that the prime purpose of these turbine-generators is to supply at lowest cost the power and steam needs of industries whose job is the making of paper, or soap, or gasoline, or some other product. It would be no service to these industries to raise the cost of power.

But it is possible to suggest the elimination of certain variables that will greatly decrease the number of possible combinations. A proposal for simplifying the variables is shown in the right-hand column of page 75. These are offered with the thought that they will fit more than half the cases without handicap. It would be absurd to think that specials would no longer be required. Certainly a plant now in existence, at 50 cycles, 11,500 volts, with initial steam conditions other than standard, would find it impossible to use the proposed standard unit. In such a case the unit bought would be considered a special, but it is unlikely that it would cost more or take longer to build than if there were no standards. *Standardization does not increase the cost of specials, it reduces the cost of standards.*

Industry is not yet ready for the simplifications proposed on page 75. It still needs the type of turbine typified by Fig. 1, even for some of the smaller ratings. Such turbines commonly maintain steam pressure constant at each of two pressures, satisfy the plant requirements for power, and often maintain frequency sufficiently constant for synchronous-motor-type clocks. What then are the possibilities for standardization?

The chief hope for the benefits of standardization in this field lies in new power plants. Engineers expanding existing power plants usually have some latitude in the choice of rated output, but have little choice in the selection of some of the most important variables. If the plant has surplus boiler capacity now at 250 psig it is unlikely that 400-psig boilers could be added. If the plant distribution is now 6900 volts it is unlikely that some other voltage would be economical.

But in new plants there is some latitude. If power-plant designers could agree on a set of standards today similar to those proposed on page 75, there would be increased hope for lower costs in the future. These standards would serve as the basis for selection of equipment for new power plants. In time there would be a transition from our present multiplicity of variables to a relatively few number. With the reduction in variables would come shorter shipments, lower costs and improved designs.

A Check With the Past. The record of units ordered during the past 15 years gives important clues to what hope there may be for standardization. Fig. 2, for example, shows that main pressure has been rising steadily since 1930, and that main pressure tends to increase as units become larger in size. It appears likely that this upward trend will continue.

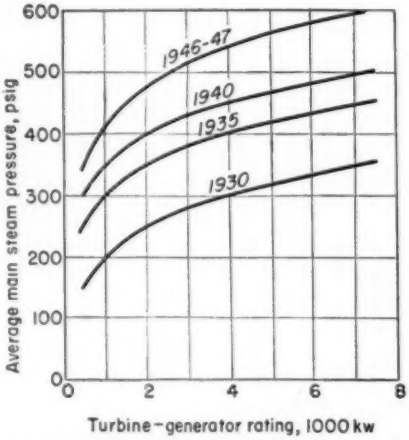
If a similar comparison of initial temperature is made it will be found that temperature increase has kept pace with the pressure increase. During the past 15 years the average throttle temperature for corresponding pressures has been as shown by Table I:

Table I—Average throttle temperature for different throttle pressures over the last 15 years.

Main pressure, psig	*Temperature, F*
150	400
200	475
400	650
600	750

A comparison of page 75 with Fig. 2 will show that the main pressures selected are equal to or higher than the average pressure in use today. Any standard should be progressive, and there is some reason to think that of the pressures suggested on page 75 it might be just as well to eliminate the 400-psig classification for any but the smallest power plants.

Not much has been said of the generators so far, but a look at page 75 shows a possible number of combinations that is measured in thousands. Of fifteen 5000-kw generators on order at the same time from one manufacturer the most that could be built from a single set of drawings was three. Users will find simplification of the number of generator variables easier of accomplishment than turbines, but it will take a program similar to that on page 75 to give direction to any such attempt.



2 **Steam main pressure for all sizes of turbines has risen steadily since 1930**

There has been a decided shift to larger size units in the past 15 years as is shown by Table II:

Table II—Percent number of units by sizes for today and for the period 1930-1935.

Range of ratings, kw:	*No. of units in % of total:*	
	1930–35	*1946–47*
Small (500-1500)	65	25
Medium (2000-4000)	25	35
Large (5000-7500)	10	40
	100	100

This shifting pattern to larger size units should materially aid standardization. Most power plants are expected to grow, so whether one 2000-kw turbine is installed every two years, or one 3000-kw turbine every three years, may not be too important. In a growing power plant the choice of ratings is less important than in one of fixed size.

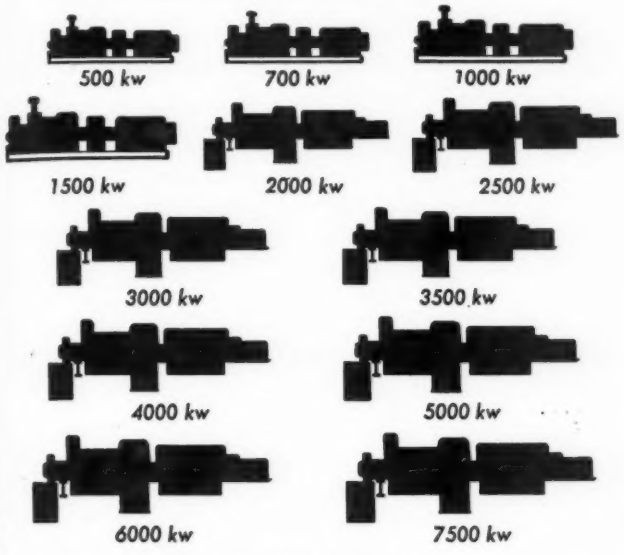
The Obstacles. Standardization of these turbines should not be lightly considered. Unless over-all power-plant costs are lowered there seems little inducement to purchasers to push such a program regardless of the gains to manufacturers of power-plant equipment. From the user's standpoint the industrial steam turbine is looked upon ordinarily as a source of both power and process steam. The user is not in the business of making power but accepts his powerhouse as one of the headaches that goes with the plant's demands for steam and power, to make paper, refine oil, or perhaps process chemicals. The nearer the turbine can be made to fit the industry, the larger the return to help pay for the capital cost. Only if the net costs of power and steam are reduced will standardization prove acceptable.

Another hindrance to early standardization is the dissimilarity of users' businesses. The oil industry has few points in common with paper making, for example, or with the small central-station power plant, or with, say, the rayon manufacturer. Yet all use turbines. To pull them together and get agreement on turbine standards may take a long time even though they

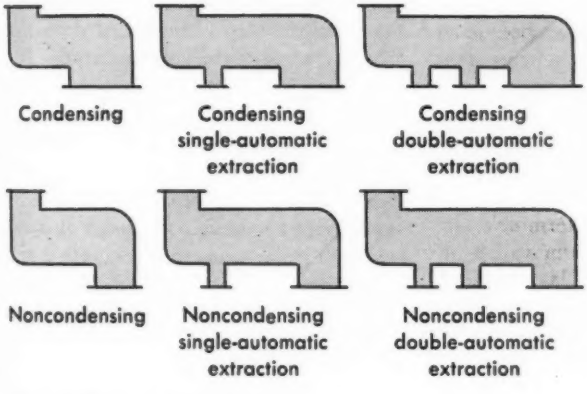
(*Continued on page* 150)

TURBINE-GENERATORS AVAILABLE TODAY

Twelve Standard Ratings:

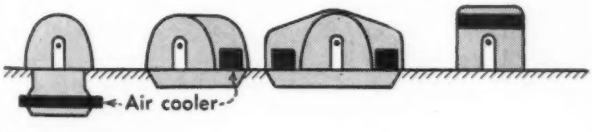


In These Six Basic Types:*



For main steam pressures of:
0, 100, 200, 400, 600, 900, 1500 psig
For initial steam temperatures of:
500, 750, 825, 900, 950, 1000 F
For exhaust pressures of:
1 in. Hg abs to over 400 psig
For automatic-extraction and low-pressure admission pressures from: atmospheric to 400 psig and for flows from 1000 to over 200,000 lb per hr

With Four Basic Air-Cooler Types:

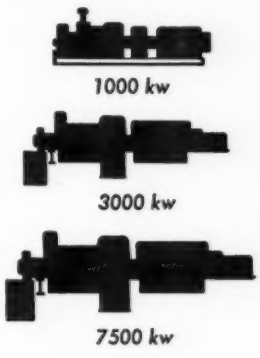


For voltages of:
240, 480, 600, 2400, 4160, 6900, 11,500, 13,800, 14,400
For frequencies of:
25, 40, 50, 60, 100, 120, 150, 180 cycles
For power factors of: 70, 80, 90, 100%
For short-circuit ratios of: 0.70, 0.80, 0.90, 1.00
Having fields wound for 125 or 250 v
With or without main exciter
With or without pilot exciter

**Exclusive of so-called low-pressure condensing and superposed*

TURBINE-GENERATOR PROPOSED STANDARDS

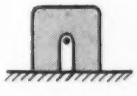
Three Standard Ratings:



In These Basic Types:

Turbine-generator rating, kw	*1000*	*3000*	*7500*
Condensing	X	X	X
Condensing single-automatic extraction		X	X
Condensing double-automatic extraction			X
Noncondensing	X	X	X
Noncondensing single-automatic extraction		X	X
Noncondensing double-automatic extraction			X
For main steam pressures of:			
400 psig	X	X	
600 psig		X	X
850 psig			X
For initial steam temperatures of:			
750 F	X	X	
825 F		X	X
900 F			X
With exhaust pressures for:			
Condensing		2 in. Hg abs	
Noncondensing		as required	
With extraction pressures		as required	

With Only One Air-Cooler Type:



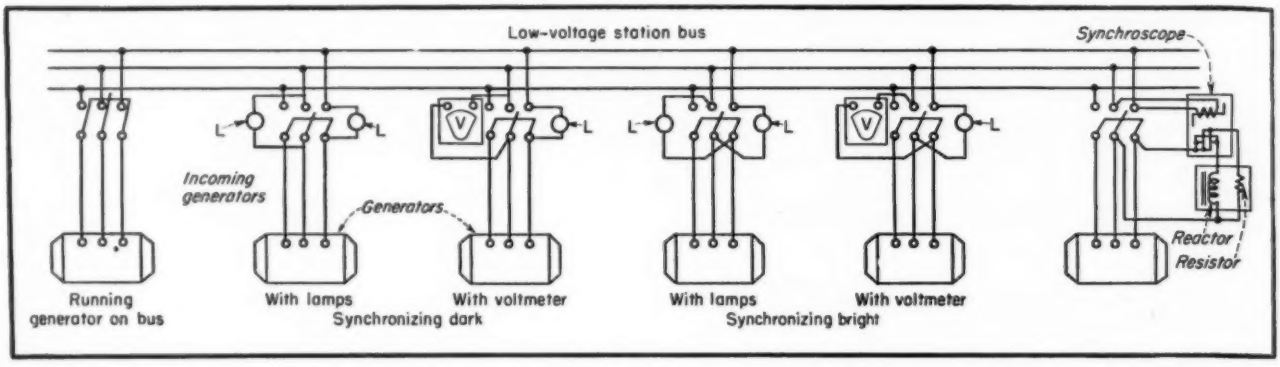
Air cooler integral with generator and above floor

For These Voltages:

Turbine-generator rating, kw	*1000*	*3000*	*7500*
2400/4160 v	X	X	X
13,800 v			X

And These Electrical Constants:

For 60 cycles
For 80% power factor
For 0.70 short-circuit ratio
For 125-v field
With direct-connected exciter but no pilot exciter



1 In power plants having two or more alternators, parallel operation is an everyday act. When two machines are synchronized some indication is needed to show when generators are in step, so a voltmeter, lamps or a synchroscope is used

What the Synchroscope Does

Voltage, frequency and phase relationship must match when alternators and systems are synchronized. James Wilson, electrical engineer, tells how one instrument sums up all values except voltage. He explains the operating principle of several synchroscopes

▶ IN AN ALTERNATING-CURRENT power plant with more than one generator, the essential instruments are voltmeter, ammeter and synchroscope. There are also some helpful but not indispensable assistants like the wattmeter, power-factor indicator and frequency meter. Before considering the synchroscope, let's glance at the functions of voltmeter and ammeter.

Voltmeter and Ammeter. To hold correct voltage, every plant must have available at least one voltmeter. In addition, each generator must have an ammeter to measure output current because the amount determines the heating of the machine. The heating in turn limits the total load that can be safely carried.

Most power plants, for over-all economy and operating continuity, have more than one generating unit. To carry the common load, these units are usually operated in parallel. This operation, to be satisfactory, requires generators of similar electrical characteristics and prime movers with speed characteristics that are alike.

Alternators in Parallel. Two polyphase ac generators, to parallel, must have equal voltages, frequencies that match, the same phase rotation, and proper phase relationship. Phase rotations are set equal at installation, and the process is called "phasing out." An ac voltmeter indicates voltages, but a check is also needed to determine when they are reaching maximum values in an individual cycle. This last test can be made with either lamps or voltmeter, but values are not so good with either medium as with a synchroscope.

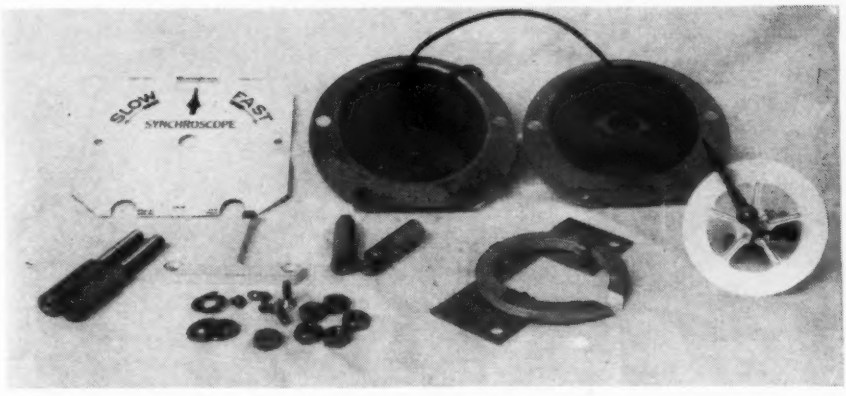
The only definite indication given by either lamps or voltmeter, Fig. 1, is that the incoming alternator is passing the point of synchronism—or is in step. If the lamps are connected so they are burning at the point of exact synchronism — *synchronizing bright* — the eye cannot distinguish the instant of maximum brilliancy. For the method called *synchronizing dark*, the dark period is shorter than the bright. Yet the eye cannot tell the exact point of no-current through the lamps, which is the point of synchronism.

If the voltmeter is used on the equivalent of synchronizing bright the indication, properly interpreted, is better than with lamps. If the voltmeter is connected for the equivalent of synchronizing dark, the point of synchronism is not clearly indicated because its pointer is at zero on the insensitive end of the scale. Synchronizing bright with either voltmeter or lamps requires a special transformer except on low-voltage systems. The synchronizing-dark method, with voltmeter, lamps or synchroscope, can use the same potential transformers provided for the regular metering. This additional load is applied only during the synchronizing period, and does not affect the instruments' accuracy for metering.

Synchroscope Operation. To parallel one ac generator with another, the synchroscope clearly indicates every condition that the operator needs to know except exact voltage. Although this instrument usually has only a single mark at top center and *Slow* and *Fast* with an arrow above each word, it shows whether the incoming generator is running at the same frequency as the bus or the other generator but not in synchronism with it. The synchroscope also shows whether the incoming generator is running slower or faster, or whether the generators are in synchronism. By the term synchronism—in step—we mean that incoming generator and bus are at the same frequency, and that voltage alternations of both have the same value and polarity at the same time.

These indications give information for the preliminary operations of paralleling a generator with a running plant, and enable the operator to close the generator switch without shock to the system. This is particularly important on lower-frequency steam-turbine plants since a small error causes large swings of power to pull the incoming alternator into synchronism. These swings place unnecessary electrical and mechanical strains on equipment.

Although synchronizing lamps are not really necessary, many plants install



2 This disassembled view of an iron-vane synchroscope uses a stationary 2-phase armature with distributed winding. The vane is actuated by the resultant flux.

And How It Works

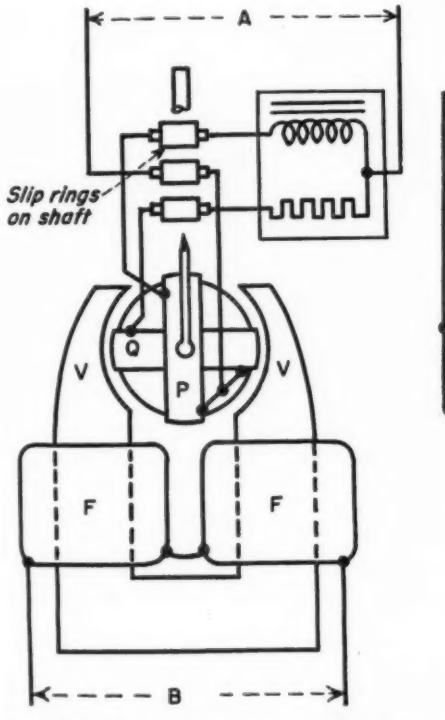
them in addition to a synchroscope. They burn brightly when the pointer is at the bottom and dim gradually as it moves toward the top mark, where the lights are completely dark. In this way, the operator has a constant check on the synchroscope and its connections.

Synchroscope operation depends on one of the following methods: (1) Split-phase bipolar synchronous motor with ac excitation, Fig. 2, 3, 4, 5 and 8. This type works by a 2-phase split of one of the synchronizing voltages. (2) Vane actuated by a resultant flux, Fig. 6 and 7. This method works by a 3-phase split of both synchronizing voltages. (3) Electrodynamometer movement, Fig. 9, similar to a wattmeter's. Methods (1) and (2) are applications of the rotating field.

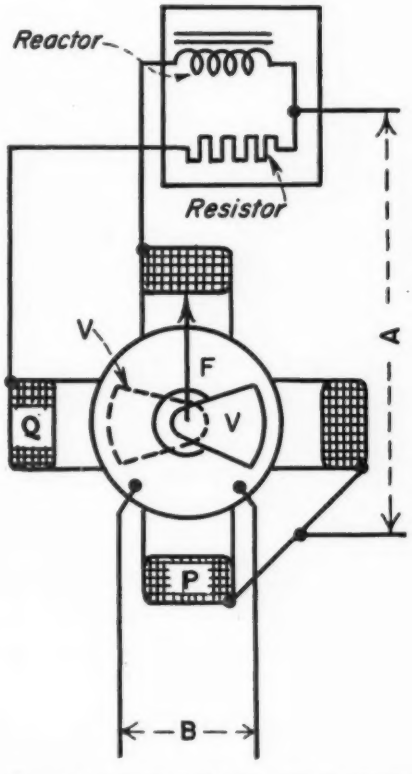
Rotating Field. The split-phase bipolar synchronous motor with ac excitation and the rotating armature is one of the oldest types of split-phase synchroscopes, Fig. 3. Its operating principle is comparatively easy to demonstrate. The rotating armature is energized by circuit *A* through coils *P* and *Q* in series with a reactor and a resistance respectively. Coil *P* circuit is highly inductive, due to the external reactor, causing current in the coil to lag nearly 90 deg behind the voltage of circuit *A*. Coil circuit *Q* with its external resistor, is but slightly inductive so current in that coil is very nearly in phase with the voltage of circuit *A*. The equivalent of a true 90-deg current difference for these armature coils is obtained by shifting them slightly from a true right angle to each other. This produces a smoothly rotating magnetic field in the armature structure, and causes the pointer to show the true phase relationship between circuits *A* and *B*.

Circuit of coils *F* is highly inductive because of the iron field poles, and its current is nearly 90 deg behind the voltage of circuit *B*, whose magnetism is oscillating in value, and fixed in position in relation to poles *V*.

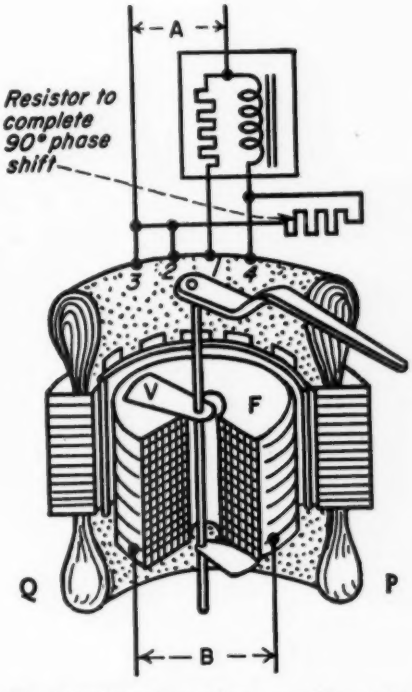
The armature rotating field coincides with that of the field poles, holding the armature and its pointer. Thus they move clockwise or counterclockwise at a rate corresponding to the difference in frequency of circuits *A* and *B*. If frequency of the circuits is the same, the pointer comes to rest at the posi-



3 Split-phase rotor and bipolar synchroscope with a revolving armature



4 This stator combines an armature and field windings; both stationary



5 Distributed winding on the stator with a phase-shift circuit is shown

tion indicating the phase relation of the circuits. If the pointer is over the marked point on the dial, the circuits are in synchronism. For each revolution of the pointer, there is a gain or loss of one cycle between the circuits being synchronized.

The synchroscope with the mechanism of Fig. 4 operates on the same principle as that in Fig. 3. But in Fig. 4 the armature is stationary and the field poles revolve.

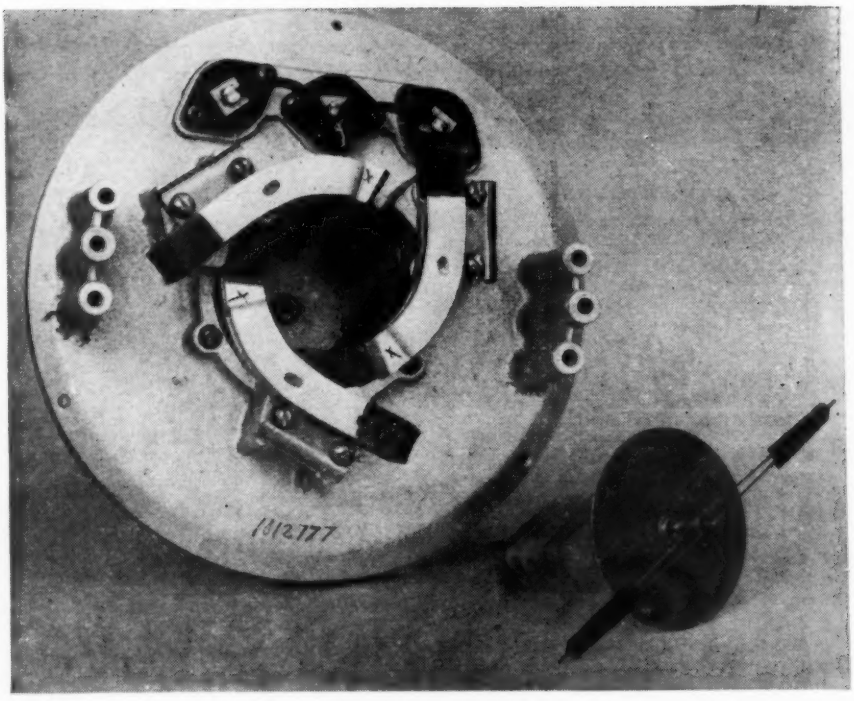
The only difference between Fig. 5 and 4 is that in Fig. 5 the armature coils are a 2-phase motor stator with a flux distributor inside to give the correct motion to the pointer.

In Fig. 3, 4 and 5, parts with the same function have the same letter for ease of comparison.

The resultant flux type of synchroscope, shown in Fig. 6 and 7, is marked by its simplicity. The stator is wound as a 3-phase motor. The rotor consists of several flat iron vanes, a damping disk and a double-ended pointer on a shaft. The phase of each of the circuits *A* and *B* is split, using a reactor, a condenser and a resistor, so voltages and currents to be applied to the stator are 120 deg apart. Then they are connected to the stator so that each one, if alone, would produce a field rotating in opposite directions. With both connected, and synchronizing potential applied, a resultant field is produced that may rotate in either direction or stand still, depending on the relative frequency and phase relationship of circuits *A* and *B*.

Dynamometer. The Weston synchroscope is a clever combination of the electro-dynamometer movement and a synchronizing lamp. The movement, schematically shown in Fig. 9, is placed so the pointer swings between the lamp and the rear of a translucent-glass scale. A pair of springs control the pointer so it is at the synchronizing mark on the scale when coil *I* has no current in it. The glass scale and pointer are illuminated so they are seen when the electromotive forces of the generators being synchronized are in the proper relation to each other.

Stationary-coil *R* circuit has but little inductance, while the moving coil *I* has a condenser in its circuit. By using the resistors in all circuits, they can be adjusted so their currents are 90 deg out of phase when the electromotive forces producing them are either in phase or in phase opposition (180 deg out of phase). Under these conditions, as there is no current in coil *I* to produce a torque, the pointer stands upright behind the scale. The image of the pointer may or may not be seen depending on whether the electromotive forces are in phase or in phase opposition.



6 Iron-vane synchroscope is partly disassembled, showing the winding, damping magnets and the moving element. The phase-shift circuit is external to the case

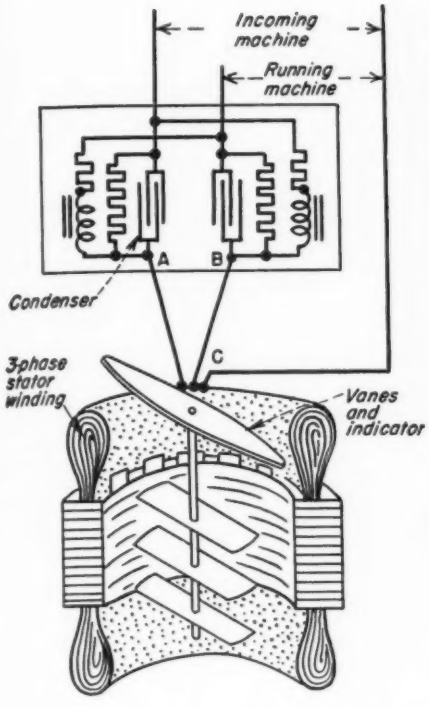
Synchronizing lamp *L* operates at a low voltage from the secondary of a special 3-legged transformer *T*, which has one primary for the incoming machine and another for the bus or running machine. When the electromotive forces on the two primaries are in phase, the effect is maximum voltage in the secondary and thus full brilliancy of the lamp, making the pointer visible on the scale. As the electromotive forces on the primaries of the transformer become out of phase, the voltage on the lamp and its brilliancy decrease until at phase opposition the lamp is totally dark, and the pointer cannot be seen although it is upright behind the scale.

When the electromotive forces are not exactly in phase or phase opposition, a torque is produced because of motor action. This torque is at a maximum when the electromotive forces are in quadrature and decreases to zero when they are in phase or phase opposition. As the electromotive forces come into phase, the coil torque decreases and the pointer approaches the mark on the scale and is seen as, at the same time, the lamp brilliancy is increasing to its maximum. As the electromotive forces pass out of phase, the pointer continues its swing and the lamp brilliancy decreases. When the electromotive forces become more than 90 deg out of phase, relative motion of coil *I* and the pointer reverses and passes back of the scale mark, but is not seen as the lamp is dark. If the electromotive forces are at exactly the same frequency, there is no change of torque on coil *I*, so it and the pointer stand still.

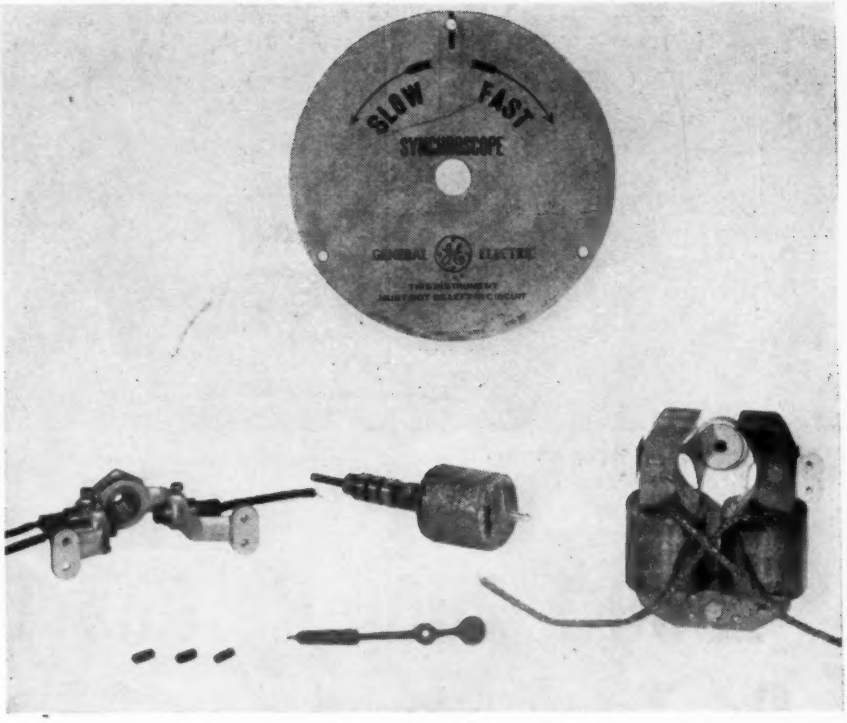
The pointer at all times shows the phase and frequency relationship at any instant of the electromotive forces in the incoming and run circuits. At the in-phase position the pointer is at the center of the black mark on the scale and the lamp at maximum brilliancy.

Instrument Transformer. Modern potential transformers have the relative polarity of the terminals indicated by either paint or the markers H_1 for primary, and *X* for secondary on or near the proper terminal. These markings facilitate making connections, and insure correct deflection of instruments. The relative polarity of the marked leads, irrespective of their position, indicates that the instantaneous direction of current is into the transformer at the marked primary lead, and out at the marked secondary lead, or vice versa.

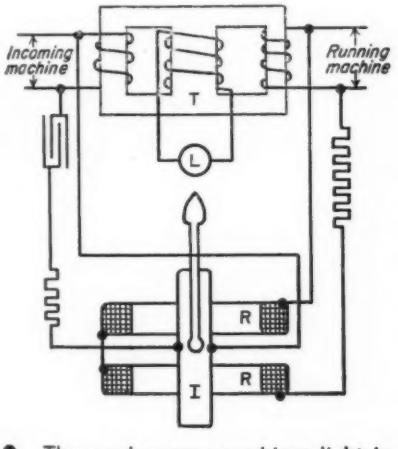
Synchroscopes should be ordered for 115 v and the frequency of the circuits where they are to be used. They indi-



7 This iron-vane element uses a winding with 3-phase distributed stator



8 The essential parts of a split-phase bipolar synchroscope, as shown in Fig. 3. The armature voltage is supplied to the rotor through sliprings on the shaft



9 The synchroscope combines light indicator and wattmeter-type element

cate properly over a range of 100 to 120 v. For any other voltage use a potential transformer that steps down to a nominal 115 v and the 115-v synchroscope. One manufacturer does, however, make a synchroscope for 230-v circuits.

Precautions. It is important at each synchronizing operation to let the pointer make at least one complete revolution as a check before closing the generator switch. The pointer should rotate smoothly and indicate with the lamps. If it does not, there may be a fault in the coil circuits, friction in the bearings, or mechanical failure, and the indication will most likely be in error. Also, if the synchroscope is used with lamps and either the incoming or run circuit becomes open, the pointer indicates synchronism even when out of phase. When this condition exists, the lamps burn at a low brilliancy and a change in speed of the incoming generator will not move the pointer.

The synchroscope is connected to the synchronizing circuits by some type of plug or rotary switch. This switch is needed to allow the selection of the incoming generator, and to disconnect the synchroscope when not in use.

The synchronizing circuits can be connected so the synchronizing operation may be performed either *machine to bus* or *machine to machine*. Whichever method is chosen when the plant is designed continues in use unless later developments necessitate a change.

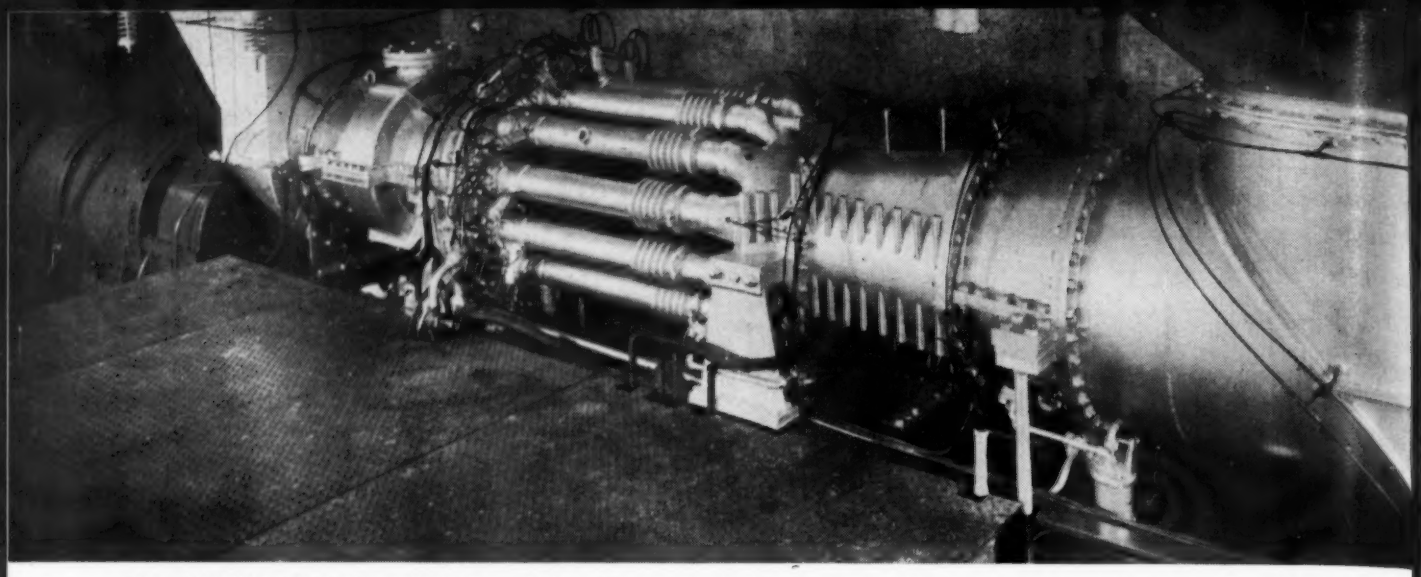
Methods of Use. Machine-to-bus operation is the simplest as one synchronizing switch key sets up all synchronizing connections. This scheme also requires a potential transformer on the bus, which can be and usually is used for other purposes.

The machine-to-machine scheme requires two synchronizing switch keys, one for the incoming generator and one for a running generator. The generators involved must be for the same bus. The operator selects the running generator, and the switch key sets up the connections for *running bus R* of the synchroscope. The key for the incoming generator sets up the connections to *incoming bus I*. An accidental interchange of these keys reverses only the indications *Fast* and *Slow*.

The synchronizing connections are not set up until the incoming generator is nearly up to voltage and frequency, say, within two or three cycles. After the connections are set up there is no difference in the synchronizing operation.

While holding the voltage to the proper value, speed of the incoming generator is regulated until the synchroscope pointer makes one revolution in about 15 seconds (30 seconds for a double-ended pointer). Then, as the pointer comes up to the point of synchronism, the operator starts to close the generator switch so it will be closed at or just before the instant the pointer reaches the mark.

An experienced operator keeps in mind the time it takes the oil switch to close after the closing impulse is sent from the control board. The few necessary preliminary adjustments of load and voltage are made after the generator is on the bus and the synchronizing handle (or handles) removed. The incoming generator is then adjusted for the most economical division of station load.



GAS TURBINE ON TEST STAND (l to r) dc generators, reducing gear, air inlet, compressor, combustors, gas turbine, stack

1350-F 2000-Hp Gas Turbine Runs On Test Stand for Over 1000 Hours

Experimental unit generates full load at 16.7% thermal efficiency with 19,500-Btu-per-lb fuel oil. Maximum output developed equalled 2220 hp with 48-F inlet air to the compressor

By T J PUTZ, *Manager*
Locomotive and Gas-Turbine Engineering Section
Westinghouse Electric Corporation

▶ A YEAR AGO Westinghouse announced an experimental 2000-hp land gas turbine, (POWER, Jan 1947, pp 98-9, 102). Tests run since, while incomplete, have gone far enough to confirm the hopes of its originators. Subsequent experience gives substantial evidence of eventual success for industrial and transportation use.

In more than 1000 hr of tests, performance has been essentially in accord with design predictions. Operation under all types of loading and up to the design temperature has caused no objectionable distortion and no serious creepage. Difficulties have not been fundamental and can be readily corrected in new designs. On the whole, experimental evidence points to the soundness of the general design.

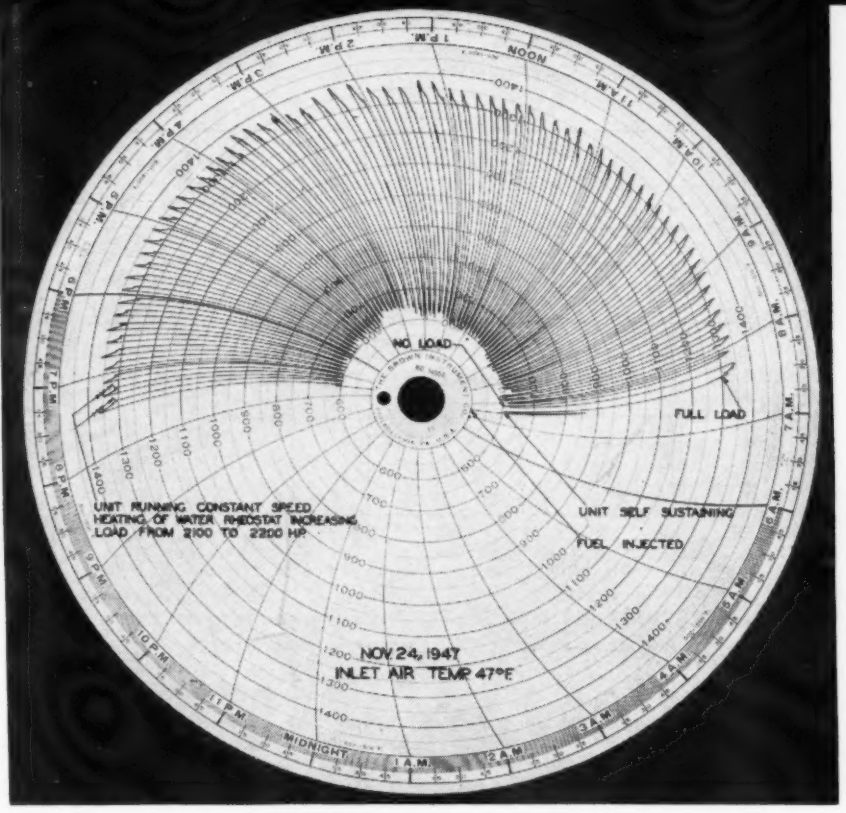
Test Results. The turbine, on test since August 1, 1946, has operated about 1000 hr, of which more than 850 hr have accumulated since July 9, 1947. Evaluating performance of the unit and its components took 300 hr. Remainder of the time was used in simulating the more severe operating cycles expected in actual service.

Accurate over-all performance has been established by reliable measurements of power output, fuel flow, speed, air-inlet temperature and atmospheric pressure. Over-all fuel rate at full load of 0.78 lb per bhphr corresponds to a thermal efficiency of 16.7%, based on the fuel having a heating value of 19,500 Btu per lb. Maximum output developed has been 2220 hp when operating with an air-inlet temperature of 48 F.

Test Procedure. Evaluation of component performance has been difficult. Many changes in instrumentation and laborious heat-balance calculations were made to achieve the desired results. Compressor performance was established by measuring air flow, inlet and discharge pressures and temperature rise. Adiabatic compression efficiency varied from 80 to 86% over the entire speed and load range.

To determine turbine efficiency in a complete plant without a dynamometer between compressor and turbine requires accurate measurement of inlet and exhaust temperatures and pressures. Of these, temperature of the combustion gas as it enters the turbine is particularly difficult to measure. Three methods were used: (1) direct measurement, using specially designed, shielded-type temperature probes (2) calculation, taking combustion efficiency as 95%, measured air and fuel flow, measured combustion inlet temperature and neglecting all losses (3) calculation, using the measured turbine exhaust pressure and temperature, measured inlet pressure and turbine work being determined by heat-balance calculation.

Turbine efficiency, obtained by using the temperature recorded by direct measurement, gave least reliable results, while the second and third methods were quite consistent and in close agreement. Turbine efficiency varied from 84 to 86% over the operating range. This is about 2 points lower than that obtained with earlier test results and



TEMPERATURE RECORD OF CYCLIC TESTS run on unit simulating short-run locomotive service. Turbine is alternately run at full and no load for 5-minute periods

is caused by the increased radial tip clearance found necessary for rapid changes in loading.

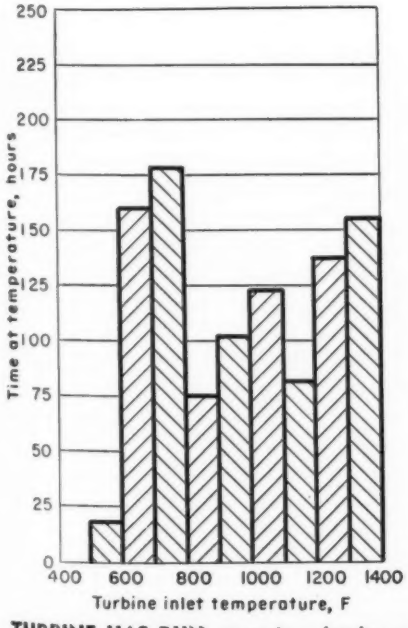
Combustion efficiency, using specially designed air-atomizing nozzles, found by heat-balance calculations, varied between 94 to 96%. These values agree closely with those of combustion tests at our research laboratories.

Operating Cycles. The unit has been started from a cold standstill condition 350 times and has undergone several thousand rapid load cycle changes from no load to full load. Loading and unloading cycle tests have proved its load-response characteristics. Probably the most severe load cycle will be in locomotive service where loading and unloading is continuous. This corresponds to rapid temperature changes of 600 to 700 F on turbine and combustor, turbine-inlet temperature being 1350 F at full load and 600 to 750 F at no load.

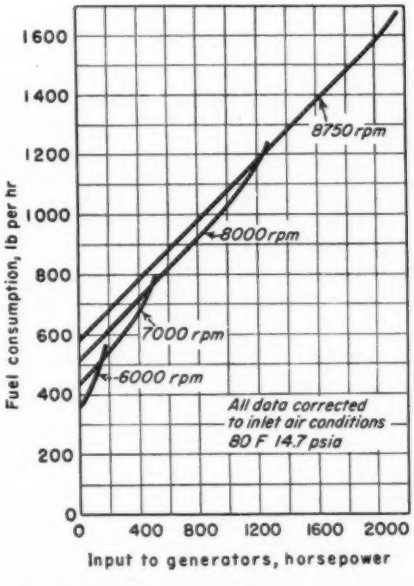
To simulate locomotive operation, the unit ran at full load 30 min, then was immediately unloaded and run 30 min at no load, whereupon load was reapplied in 10 to 20 sec and the cycle repeated. This cycle was then changed to limit the loaded and unloaded time to 10 min instead of 30. To accelerate the program, a further change to 5 min was made when tests established that this time was sufficient to heat and cool parts subjected to rapid temperature variation. Chart at left shows typical load cycle run.

Starting. The unit starts easily, one generator being used as a motor. Time required is a function of starting power available. When this power is limited to a maximum of 35 kw, the unit can start in about 2½ min. With a maximum of 80-kw starting power, it runs in 1 min. With 20 kw the time is 8 min. When the rotor reaches 15% speed the acetylene igniters are turned on and at 25% speed the fuel is injected. Starting power is shut off at the end of 1½ min and the unit reaches a stable self-sustaining speed in about 2½ min. A gas turbine of this type can operate at full capacity 10 min from the time starting is initiated, or even less if necessary.

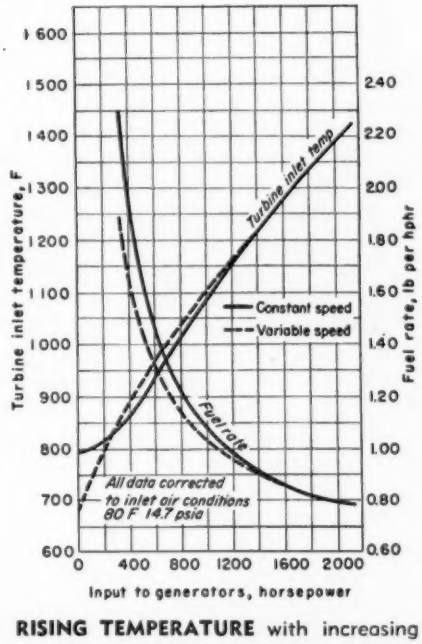
Troubles and Remedies. During the early test weeks the compresser inlet and exhaust ducts were equipped with



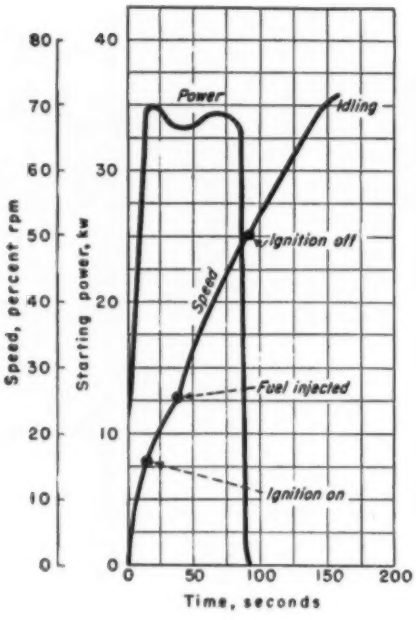
TURBINE HAS RUN at various loads up to Mar. 15, 1948 as temperatures show

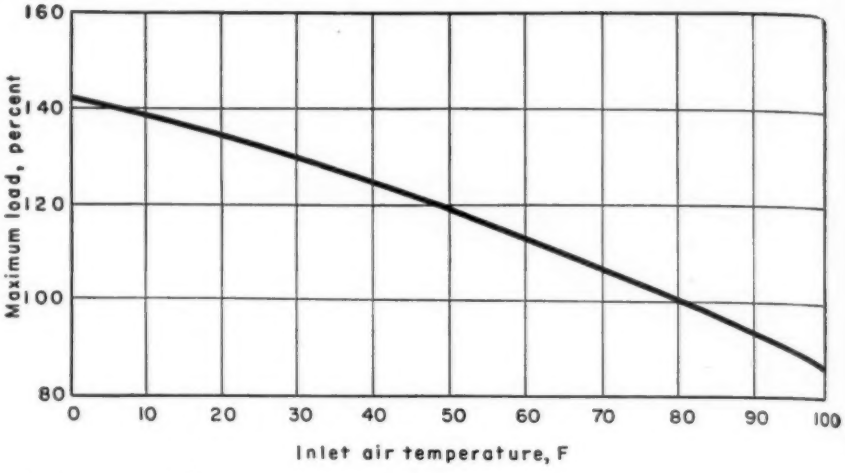

Fuel consumption, lb per hr
8750 rpm
8000 rpm
7000 rpm
6000 rpm
All data corrected to inlet air conditions 80 F 14.7 psia
Input to generators, horsepower

FUEL INPUT INCREASES with load and speed, no-load fuel about 1/3 full load


Turbine inlet temperature, F
Fuel rate, lb per hphr
Turbine inlet temp
Constant speed
Variable speed
Fuel rate
All data corrected to inlet air conditions 80 F 14.7 psia
Input to generators, horsepower

RISING TEMPERATURE with increasing load causes sharp reduction in fuel rate





DECREASING INLET-AIR TEMPERATURE entering air compressor causes rise in maximum capacity of gas-turbine unit running at maximum speed, 1350-F temperature

UNIT can be readied for loading (left) within 2½ min from cold standstill start

sound suppressors. When it became apparent that the noise level in the test house and surrounding areas was not objectionable to operators and other workers the suppressors were removed.

The unit has also operated without an air filter at the compressor inlet. The compressor blading becomes covered with oily soot after about 100 hr of operation, causing a compressor efficiency drop of about 2%. The blading is cleaned by turning the unit over slowly with the starting motor and spraying a noncorrosive commercial solvent into the compressor inlet. After soaking for a few minutes, a steam spray washes off the blading. No part of the compressor has to be dismantled.

Partly completed replacement parts were available; yet three months were needed to restore the unit to operation, each time, when two important casualties occurred, one on the turbine, the other on the compressor, as follows:

1. Failure of the turbine blading followed 57 hr of operation. This resulted from a severe rub caused by movement of the turbine-inlet bearing support during rapid temperature changes. Tests following the failure indicated the inlet bearing support deflected downward about 1/16th in. with sudden increases in temperature, returning to its correct position after temperature equilibrium was established. Method of supporting the turbine inlet bearing has been changed, and no rubs have since occurred.

2. After 125 hr of operation, stationary compressor blading failed from fatigue at the blade root caused by forced vibration. Fortunately, the failure was discovered before many blades failed completely. Rotating blades, except the last row which was replaced, were undamaged. Stationary blading was replaced using the original blade design, modified to accommodate a riveted shroud.

Strain gages were also installed on this blading and have revealed the nature of the forced vibration. Although some minor mechanical failures in the stationary blading still occur because of the difficulty of incorporating all desirable features in an original design, future designs should be free of this trouble.

No. 3 furnace oil has been the fuel for most of the testing. Tests with bunker-C oil showed an increase in plant fuel rate of about 8%, partly due to its lower heating value and partly to lower combustion efficiency. Investigations after 30 hr of operation with the bunker-C oil revealed erosion of a critical part of the fuel nozzle that seriously affected its spray angle. Subsequent tests with these nozzles showed that this change in spray angle, while seriously affecting efficiency when using bunker-C oil, had no appreciable effect when the No. 3 furnace oil was used. A new set of nozzles, designed to eliminate erosion, is now in use.

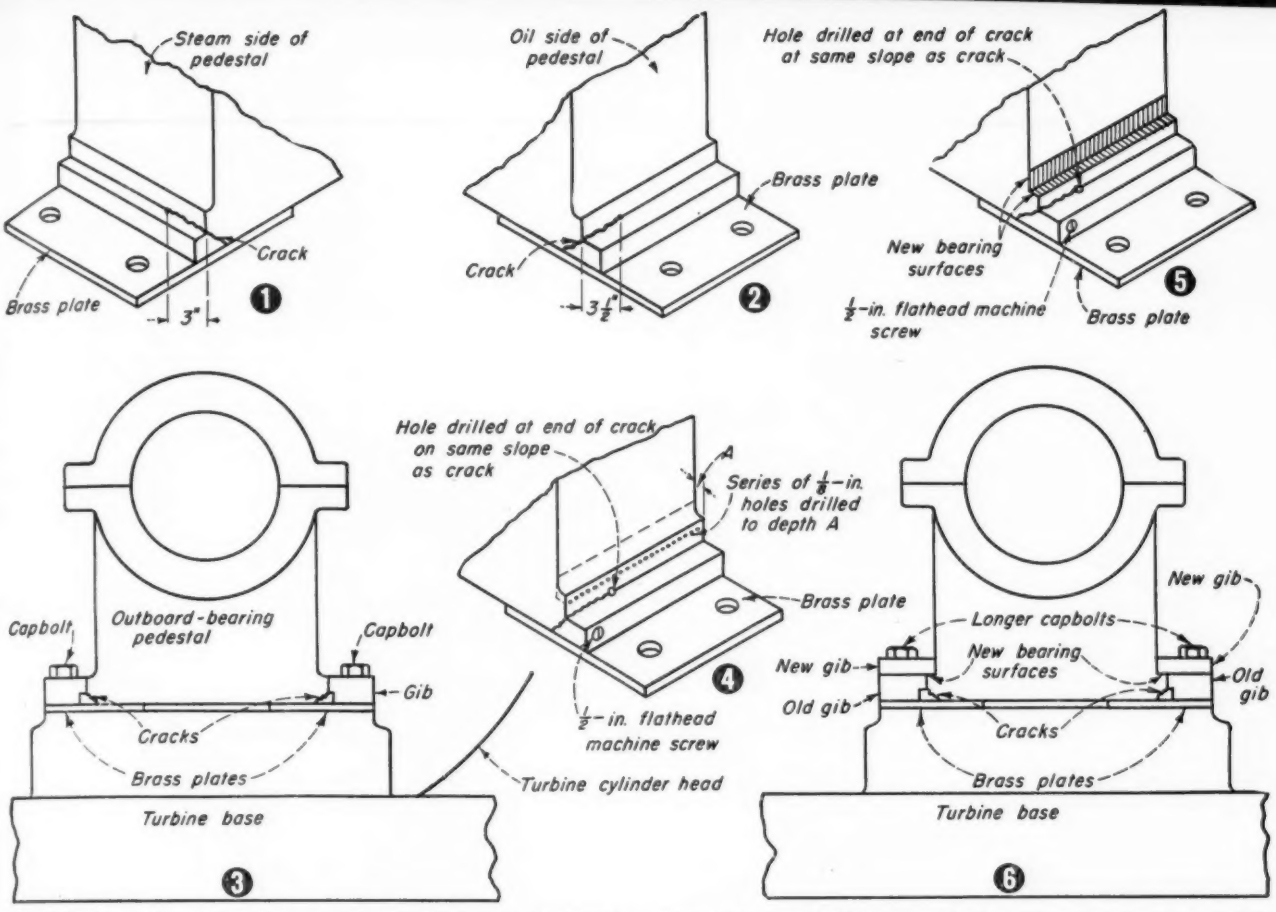
Future Program. The future experimental program will continue the cycle testing to gain further operating experience and to design and test controls for particular applications. Tests will be conducted with heavy bunker-C oils.

Actual field application will determine life characteristics of this unit. Testing has progressed to the point where actual life tests must be made. To prove this type of power plant, consideration is being given to some field application where fuel costs are low and 100% reliability is not immediately essential.

Test results and operating experience are most encouraging. Unit is easy to start and control, runs smoothly, and is not excessively noisy. Some sacrifice in efficiency has been made to gain reliability by increasing blade clearance.

None of the heated parts of the unit has shown any distress. There has been no measurable creep of any stressed high-temperature part. Fluorescent penetrant tests have revealed no cracking or heat checking on parts subjected to rapid temperature variations.

Experience indicates that this type prime mover can be made practical for power generation using heavy fuel oil or gas. Tests have clearly shown that a simple open-cycle gas-turbine power plant having a fuel rate of 0.6 lb per bhphr can be built. For this higher efficiency, units of larger capacity are necessary, because turbine and compressor efficiencies are affected by clearance areas. Maximum or near-maximum component efficiencies occur with blade heights at least twice those in the present machine. In addition, cost per hp of a larger unit should be substantially less.



1 and **2** Heavy line shows where cracks developed. **3** Outboard bearing on turbine is held to bedplate by gibs that permit lateral movement. **4** New gib land was cut on dotted line and row of drilled holes. **5** New gib land was cut as shown by shaded area; hole was drilled at end of crack to prevent it extending farther into metal; cracked portion is tied to pedestal by a flathead countersunk machine screw. **6** The completed job shows the new gibs in place on top of the old ones

Simple Tools Repair Pedestal Cracks

When a large steam turbine's bearing pedestal cracked in two places, welding or machine-shop repair was impracticable. A R Eastcott, Princeton, B. C., tells how the plant mechanic came up with a solution that required only simple hand tools

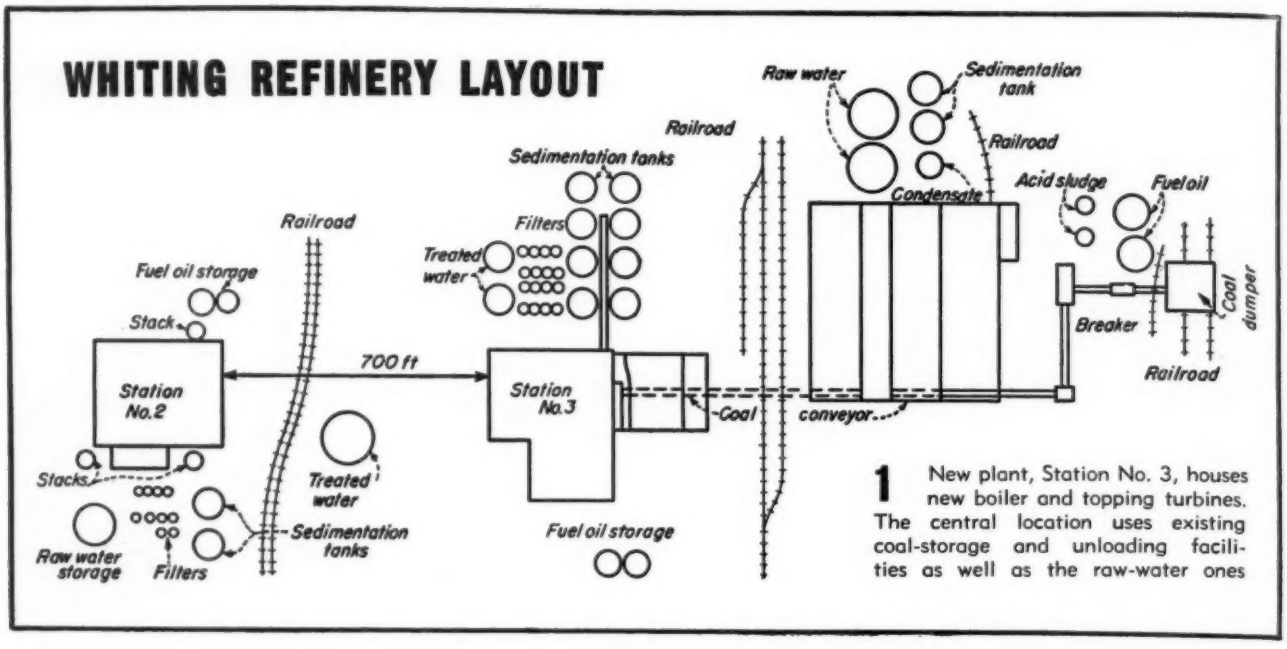
▶A 10,000-KW TURBINE developed cracks on both sides of the No. 1 bearing pedestal, where it is held to the turbine frame by gibs, Fig. 1, 2 and 4. The pedestal, cast integral with the turbine cylinder head, is free to move axially on two brass pads as the turbine cylinder expands and contracts, being merely held in place vertically and laterally by the gibs. Examination showed that the cracks extended downward almost to the base of the pedestal, Fig. 4. When the gibs were removed the cracks were found to extend rearwards for 3 in. on one side and 3½ in. on the other, Fig. 1 and 2.

How to repair the pedestal was the $64 question that stumped the experts. Welding or brazing seemed impossible because of the difficulty of preheating such a large casting without warping or cracking the pedestal and cylinder head. Repairing it by machining was also not desirable because of the inability of local machine shops to handle parts of this size.

Hand Drilling. The plant mechanic finally came up with the right idea. He proposed drilling a series of small holes along the line indicated in Fig. 4 to an accurately gaged depth equal to *A*, then chiseling out the metal between the dotted line and the holes, finally, accurately filing and scraping a new bearing surface for the new gibs, as shown in Fig. 5.

His suggestion was accepted, and in a few days he completed the job as in Fig. 6. Further spreading of the cracks was stopped by drilling holes at the rear end of each, on the same slope as the crack, Fig. 5. In addition, the cracked metal was prevented from working by drilling and tapping horizontally through the crack and installing a ½-in. flathead capscrew in each side of the pedestal.

The final repair job was completed, Fig. 6, by the addition of two new gibs on top of the old ones. Height of the latter was reduced in the shaper to suit the new bearing surface. Clearances were carefully adjusted by shims to provide greater clearance on the old bearing surfaces than on the new. This removed any possible strain on the damaged part of the pedestal.



1 New plant, Station No. 3, houses new boiler and topping turbines. The central location uses existing coal-storage and unloading facilities as well as the raw-water ones

Topping Stretches Refinery Steam

Standard Oil of Indiana meets need for more electrical energy per lb of process steam; solves problem of 1350-psi 900-F operation with 100% makeup by carefully studied water-treatment program and installation of dual-circulation steam generator

By D A MONRO and A T MILBROOK, *Standard Oil Co of Indiana*

▶ REFINERY OPERATION over a period of years has been marked by a rapidly increasing demand for electrical energy paired with a much slower increase in steam requirements. The Whiting, Indiana refinery of the Standard Oil Co of Indiana applied a high-backpressure cycle for byproduct generation of electricity as early as 1928. Plant growth soon consumed all available energy.

Two plans presented themselves for meeting this situation: (1) condensing turbine-generators operating at the 400-psi plant pressure (2) topping units to exhaust into the existing 400-psi level.

With a condensing cycle, power generation alone demands 11 lb of steam per kw, and about 70% of the heat in this steam is lost in the condenser.

Byproduct Power. A topping cycle gives additional power with no increase in steam production and only a small increase in fuel consumption to meet the increased steam pressure. For example, steam at turbine throttle conditions of 1250 psi, 900 F, generates an additional kw for each 34 lb of steam exhausted into the 400-psi header. Taken another way, for each 1000 lb of 1250-psi steam used at 400 psi by the refinery, about 30 kw of byproduct power is available. Extra fuel for generating steam at 1250 psi as compared to that for 400 psi amounts to 10%.

Selecting Pressure. Once the topping cycle plan was adopted the next step was selection of topping pressure level. As the difference between initial and exhaust pressures of the topping turbine decreases, amount of byproduct power available also drops off. For instance, the power available from 1000 lb of 900-psi 825-F steam exhausting at 400 psi comes to about 70% of that from 1250-psi 900-F steam at the turbine throttle for the same exhaust.

At Whiting boilers already operating set the exhaust conditions for the topping unit at 400 psi, 650 F. Talks with boiler and turbine makers led to the decision to hold turbine throttle pressure and temperature within the range of established pressures.

Performance data, for topping turbines of the size, type and efficiency suitable for exhaust at 400 psi, 650 F, indicated a selection of throttle conditions from 900 psi, 825 F; 1250 psi, 900 F; 1385 psi, 925 F; 1525 psi, 950 F; 1850 psi, 1000 F.

Although temperatures at the throttle could be raised by using a thoroughfare desuperheater in the exhaust, we decided against 900-psi throttle conditions because available power seemed too small for future needs. On the other end of the scale, the 1850-psi 1000-F possibility, equipment capable of handling such a temperature was not sufficiently developed at the time.

That narrowed it down to a range of pressures from 1250 psi to 1525 psi. Economic advantage possible from pressures above 1250 psi were slight.

Fitting Plant Load. We were now ready for a study of operating conditions. Available condensate from refinery operations is small, likely to be contaminated, too widely distributed to collect. That meant almost 100%

(*Continued on page* 86)

HERE'S THE HEART OF THE PLANT — DUAL-CIRCULATION DESIGN

Three dual-circulation steam generators deliver 300,000 lb per hr each of 1350-psi 900-F steam, with essentially 100% makeup. While ability to generate steam with minimum blowdown made this unusual design economically attractive, the ability to operate with low concentrations in highly heated tubes and low silica concentration in the steam influenced selection.

In outward appearance the unit resembles a conventional 3-drum boiler. It has, however, two separate heat-absorbing sections, each with its own independent circulation system. One section, the primary or high-duty one, comprises the radiant-heat-absorbing furnace. The second, low-duty section consists of convection surface.

One Steam Outlet. All feedwater enters the primary section and all steam for the plant is delivered from it. Continuous blowdown from this section feeds the secondary, and steam produced in the secondary section is condensed in the primary. Total blowdown leaves the unit from the secondary section.

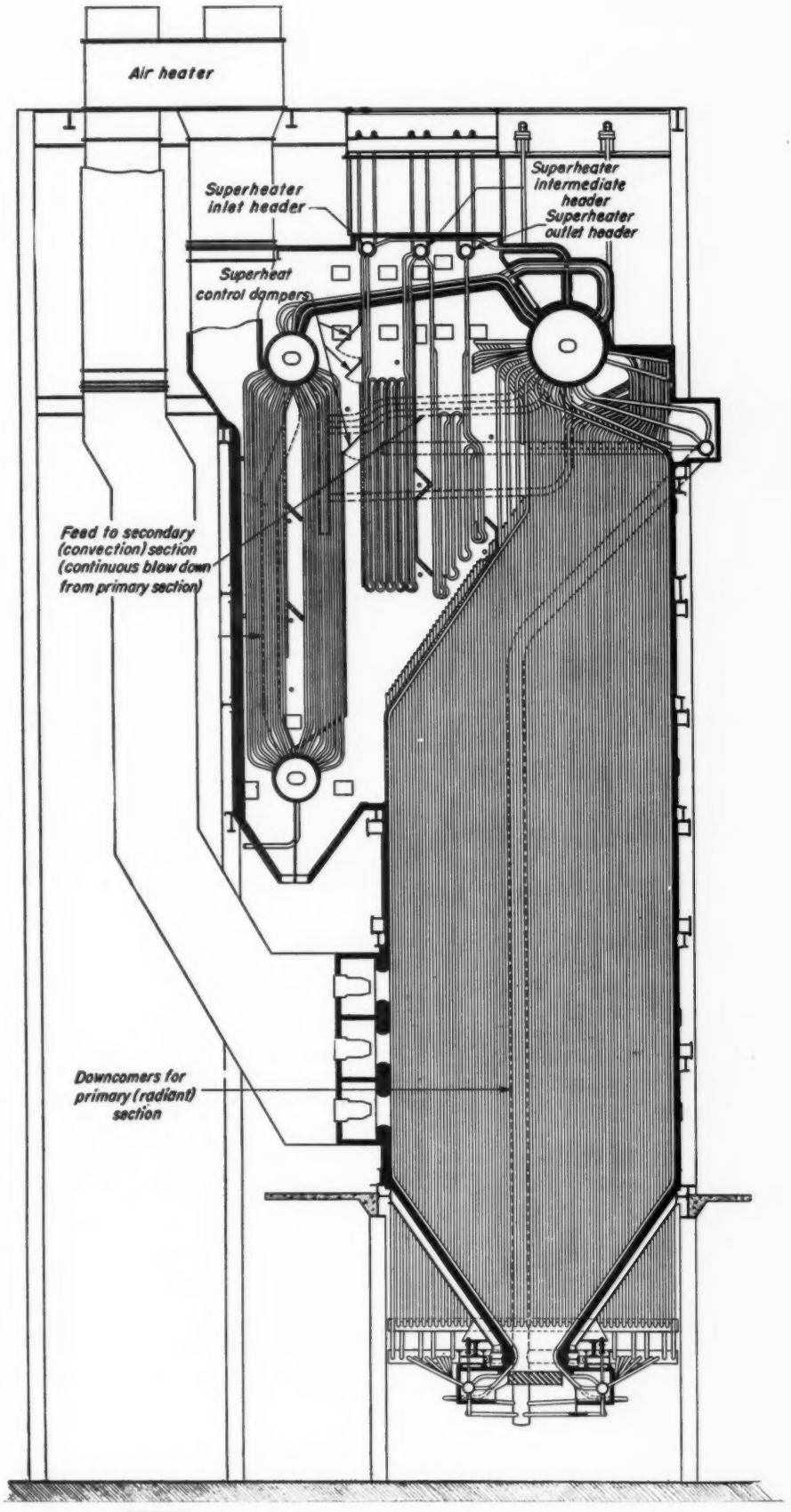
Feedwater at 240 F enters a compartment in the primary-section main drum. There it is heated by condensation of steam produced in the secondary section. From this point it passes into the main body of the drum. Pipes distributed along the drum carry the water to two large external downcomers.

Independent circuits for each of the corner tubes and the adjacent pairs insure positive circulation in these relatively low heat-absorption-rate portions of the waterwall. Flow in wall tubes is upward.

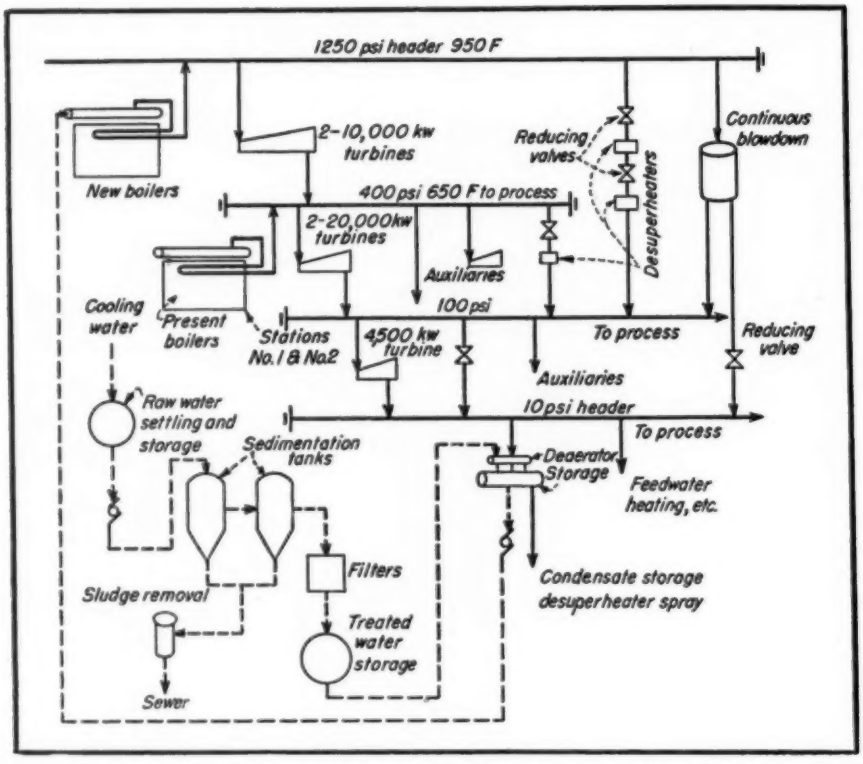
Special Blowdown. Steam-water mixture leaving wall tubes passes through washing and separating compartments in the primary drum. Water of high concentration is collected and sent through external circulating tubes to the secondary-section upper drum. Thus blowdown of the primary section forms feed for the secondary. Since its magnitude in relation to steam generated in primary section is high, concentration is kept low.

Absorbing heat from convection surfaces, the secondary section generates steam for delivery to the primary section. Because rate of heat input is relatively low, concentration in this section can be much higher than in the primary. Final blowdown is from the secondary section.

Boiler Advantages. Summing up, dual-circulation design reduces blowdown rate and heat loss from it, and lessens likelihood of tube failures by keeping concentration low in areas of high heat absorption. Silica carryover has been shown* to depend on: silica concentration in boiler water, pressure, and pH of boiler water. With pH properly controlled by feedwater treatment, dual-circulation design results in minimum production of silica vapor because: (1) steam generated from highly concentrated secondary-section water is completely condensed in heating incoming feed, and (2) steam leaving the boiler is produced in the primary section where boiler-water concentration is low.


Air heater
Superheater inlet header
Superheater intermediate header
Superheater outlet header
Superheat control dampers
Feed to secondary (convection) section (continuous blow down from primary section)
Downcomers for primary (radiant) section

* Steam Turbine Blade Deposits by Professor F G Straub, University of Illinois.



2 Steam from the dual-circulation boilers enters new 1250-psi header for distribution to the refinery and to the topping units for byproduct power

makeup for the boilers. Several of our refineries successfully use raw Lake Michigan, Mississippi or Missouri water as boiler feed at pressures up to 600 psi. Enough of it serves as cooling water for process units to make it attractive to (1) return it to the power plant after process use at 120 to 180 F (2) treat it chemically for boiler feed.

A recent wartime expansion of our 400-psi steam-generating capacity to 1,000,000 lb per hr required a feedwater-treatment system upon which we drew for our high-pressure planning. That system reduces boiler feed to the lowest hardness possible from use of a 2-stage hot-process treatment—a lime-soda stage supplemented by phosphate treatment in an external sedimentation tank with filtration and deaeration.

In addition to our own water-treatment system we reviewed the experience of several operating high-pressure boilers (1200-1500 psi) with 100% makeup. These employed zeolite cold-water treatment. Installations equipped with ordinary hot-process treatment fell in the 900-psi range.

Silica Troubles. Certain of the high-makeup 1200-psi plants under study reported silica troubles in turbines. In fact, many plants with small makeup indicated a growing awareness of the silica problem in boiler water.

Since a large portion of the steam supplied from the high-pressure topping unit normally would go throughout the refinery to steam turbines driving pumps, blowers and fans at throttle pressures of 400 and 100 psi, silica troubles were of major interest. Pressures and temperatures in this range form the region where silica deposits are most likely to occur. Their control was a prime consideration.

The National Aluminate Corp expressed the belief that a 1500-psi boiler could operate successfully with 100% makeup from Lake Michigan water treated in a hot-process softener. They conducted experiments on a pilot boiler* to determine nature of boiler scale at this pressure with water treated as we had at Whiting. These experiments indicated safe operation.

An investigation on a commercial scale by this same company showed that dolomitic lime and magnesium oxide added to a hot-process lime-soda softener gave water of less than 1-ppm silica leaving the softener. Slight improvements in design, plus sludge recirculation under close control, reduce silica content still further below 1 ppm.

Plant Design. With this background of economic and operating studies Stone & Webster Engineering Corp were called in to design a station employing topping turbines to operate at 1250 psi, 900 F at the throttle. Three prime requisites influenced design (1) the least over-all cost possible for steam and power (2) continuous service (3) dependability.

Foster Wheeler Corp designed dual-circulation boilers, p 85, for operation at high pressure incorporating these requisites. They can fire pulverized coal, oil or gas. A conservative heat release, 13,700 Btu per hr per cu ft, makes for flexible operation both from fuel and high makeup considerations.

Under operating conditions at Whiting—feedwater with total soluble solids of 150 ppm, 1 ppm silica; a boiler water of 10 pH; a steam of 0.1% moisture—the problem of silica reaching refinery equipment at the 400- and 100-psi level does not appear too serious with these dual-circulation boilers supplying steam. Moreover, blowdown losses are much reduced compared to a conventional boiler.

Recommended Levels. For a conventional boiler operating at 1000 to 1500 psi an 18% blowdown brings boiler-water concentration to the 1000-ppm level recommended by the American Boiler Manufacturers Association. Solids carryover with the steam runs about 1 ppm. Under these conditions, avoiding silica deposits requires keeping total silica concentration in the boiler water below 5 ppm; the pH about 11.0; the silica content of the steam below 0.1 ppm.

A comparison of these factors between the standard and the dual-circulation boiler shows how well the dual unit meets this problem. The dual-circulation boiler has two separate circulating systems, p 85, one in the convection area, and the other in the radiant. All steam entering the 1250-psi header comes from the primary or radiant zone. At the 18% blowdown, secondary section shows boiler-water concentration as 1000 ppm, silica content 6.7 ppm. The primary section—the one supplying steam to the main—shows boiler-water concentration 352 ppm, silica content 2.36 ppm, total solids carryover 0.35, and silica in steam 0.024 ppm.

A further precaution against solids carryover comes from the unusually large steam-collecting drum, radiant section in Fig. 2. Drum internals were subjected to tests by the manufacturer on a full-sized cross-sectional element of the drum.

More details of plant layout and operation follow in a second article.

* *Experimental Studies of Boiler Scale at 1500 Psi*, by J A Holmes and C Jacklin.

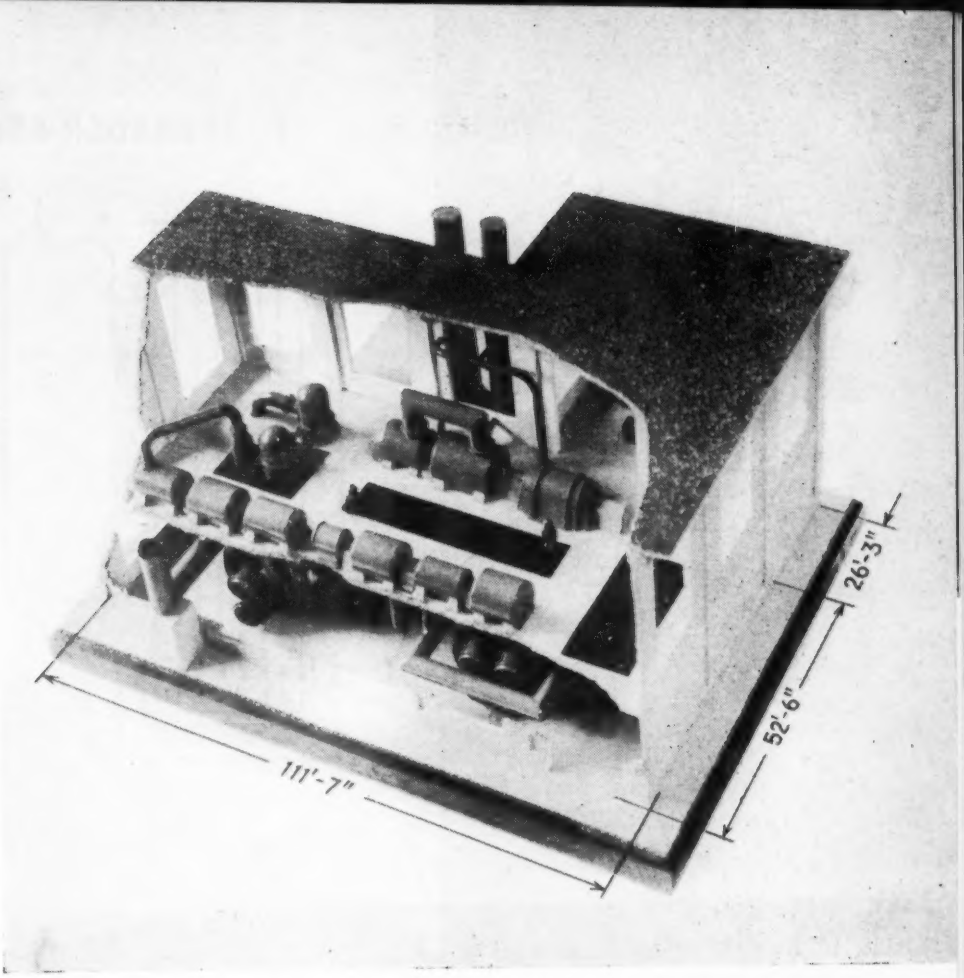
20,000-Kw H-P Gas Turbine Under Way in Switzerland

▶ EXPECTED TO BE READY for service in the winter of 1949-50, a 20,000-kw high-pressure gas-turbine plant is under construction at Sulzer Bros, Wintherthur, for the Nordostschweizerische Kraftwerke A G. Its output will supplement the Swiss hydro system during the cold-weather months.

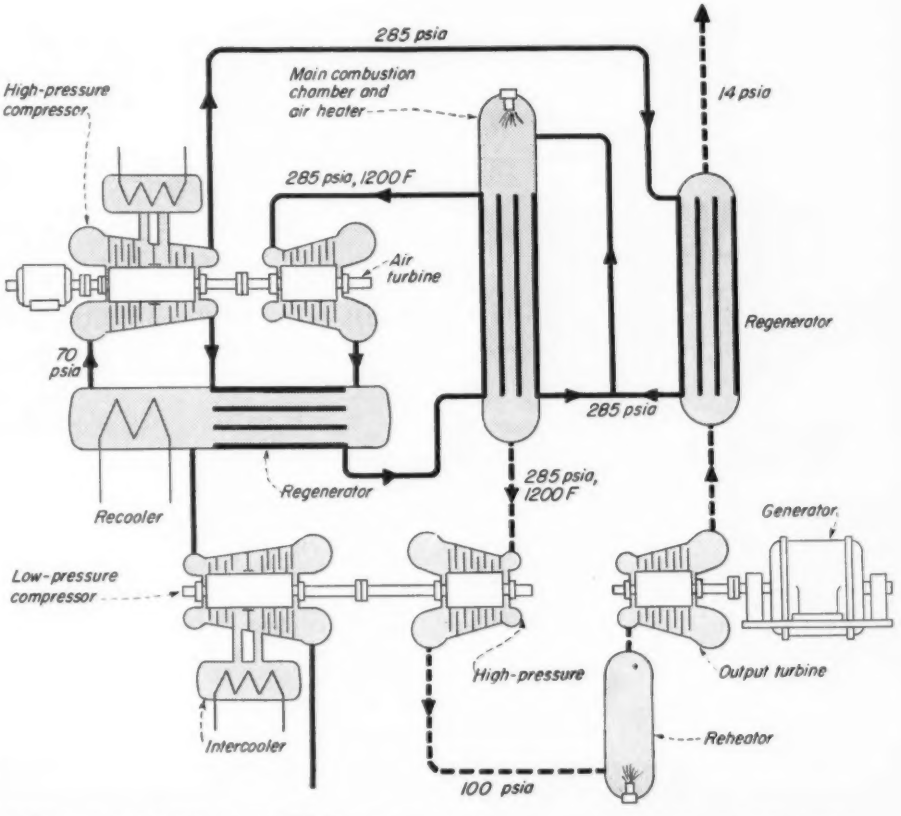
The model shows general arrangement of equipment in a building about 112x79 ft. Operating on the h-p cycle with turbine-throttle temperatures of about 1200 F, efficiency is expected to exceed 30% on heavy fuel oil.

Semi-closed Cycle. The h-p or semi-closed cycle is believed particularly suited to plants of large output as the high density of working fluid resulting from pressurized operation permits smaller machinery and piping. As shown in the diagram (a modification of the design described in POWER, May 1946, p 74, and Oct 1946, pp 84-85) a closed cycle handles clean air only. This consists of a 2-cylinder intercooled compressor driven by an air turbine, a regenerator and a recooler, which restores the circulating air to original temperature conditions. Air from this cycle supports combustion in a heater, which raises closed-cycle air temperature indirectly and supplies combustion products to two gas turbines, one driving the compressor pumping fresh air into the closed cycle and the other driving a generator to furnish useful output. Gas turbines are in series, with a reheater between.

The air-heater and combustion-chamber combination, in which fuel is burned in the working medium, operates with equal pressure inside and outside the tubes, which eliminates stresses in tube metal working at high temperature. High pressure on the gas side increases specific-heat transfer. The net effect is a considerable saving in air-heater space requirements.

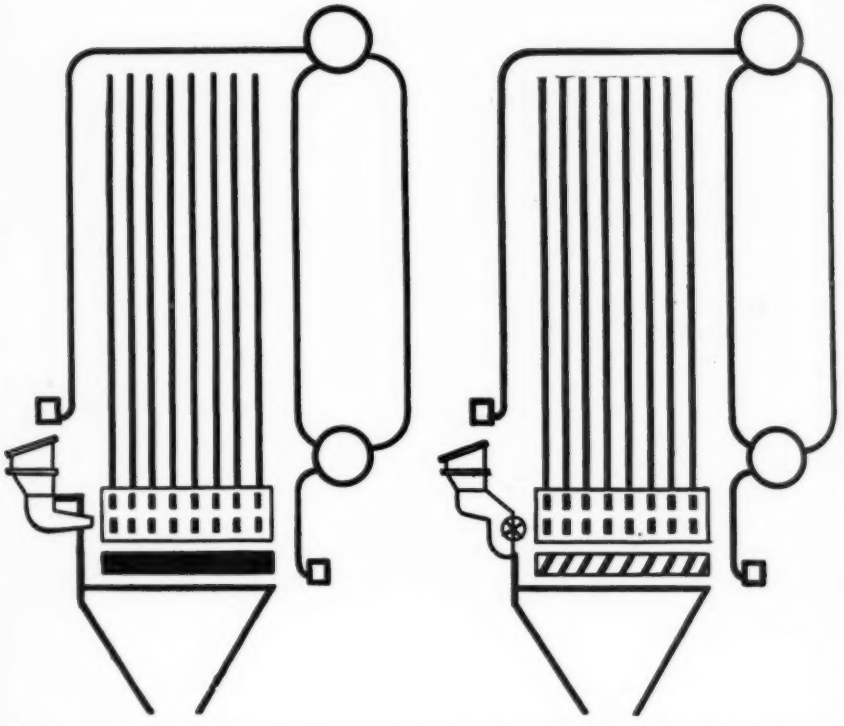


PLANT MODEL: Foreground, compressors and driving turbines; background, turbine-generator, and upper part of combustion chambers; below, coolers and regenerators



HOOKUP REVEALS OPERATION: Plant consists essentially of two circuits, one handling only clean air (solid lines) and other combustion gas (dashed lines)

1 SPREADER-STOKER FURNACES EMPLOY



SPREADER STOKERS fire a wide range of coals. Choice of fuel-bed grate depends more on the steaming requirements than upon characteristics of coal

Want Your Overfeed Stoker to Be

Here are pointers that you can put to work to insure combustion without smoke. What's more, fundamentals of theory and operation are included for overfeed stokers—chain, traveling-grate or spreader—that add up to helpful operating know-how

By L N ROWLEY, *Managing Editor*, and J C McCABE, *Assistant Editor*

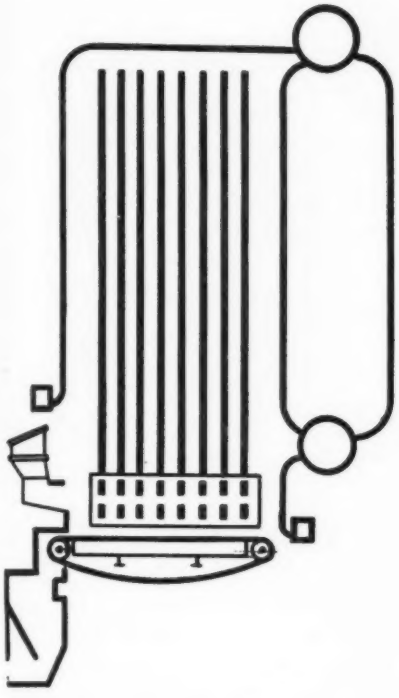
► WAY BACK IN the August 1947 issue of POWER when we talked of "How Fuel Burns" (p 71), we set up two fuel-burning groups for solid fuels: (1) suspension and (2) fuel bed. An article on the first, suspension or pulverized-coal firing, appeared in January 1948 (p 76).

Let's look now at the second, fuel-bed firing. It can be done by introducing coal mechanically with stokers, or by hand. With stoker firing, two major methods of supplying coal are employed—overfeed and underfeed. By far the majority of overfeed stokers in power-plant service employ the spreader, chain- or traveling-grate arrangement.

Stoker Firing. In all stokers firing proceeds in four steps: (1) Coal is pushed, dropped or thrown into a high-temperature region within a furnace. (2) A part of the coal is distilled off as a combustible gas (mostly hydrocarbons and CO) and burned above the fuel bed just like a gaseous fuel. (3) Remaining solid or coke stays red hot and experiences a vigorous scrubbing by air until completely burned. (4) Ash is removed from the furnace zone.

Spreader stokers, Fig. 1, take raw coal (within definite size limitations) whirl it into suspension within the furnace by (1) pneumatic or steam nozzles or (2) paddles or wheels that throw the coal supplied from an over-

VARIOUS FUEL BEDS



CONTINUOUS DISCHARGE of ash on moving grates aids large steaming units

Smokefree?

Tips for Smokefree Operation

- Watch fuel-size consist
- Avoid segregation of fuel
- Keep fuel bed level
- Hold overfire draft low
- Keep fire and ashpit clean
- Provide enough furnace volume
- Establish turbulence
- Guard against air leakage
- With spreaders, use controls

feed or underfeed hopper source. Fines tend to burn in suspension, larger sizes drop to the fuel bed.

The fuel bed may be one of three types—stationary, dump or continuous discharge, Fig. 1. Choice of grate type depends more on steaming requirements and less on coal characteristics.

Stationary grates prove satisfactory for small-capacity boilers, particularly those employing low-ash coals on hand-cleaned grates. Dumping grates fit well into medium-sized installations; continuous discharge or traveling grates, into large-sized steam generators.

Dumping grates require certain conditions for best results. For instance, the grate should be power operated. Furnace should be designed in sections, that is, grate-surface sections should have separate forced-draft supply, grate and ashpit. This arrangement permits cleaning one section of grate without interrupting or disturbing firing on neighboring sections.

Continuous discharge units get around the problem of interrupting steaming capacity for ash cleaning by removing it continuously and automatically on a moving grate.

Class of Fuel. Spreader stokers fire a wide range of coals (from lignite through bituminous). Anthracite—that is, 100% anthracite—has not yet proved successful as fuel. It piles up in front.

Other coals, however, as well as many byproduct fuels like coke breeze, burn well with spreader-stoker firing. Sizing of fuel is highly important. Top size, for coal, is about 1¼ in. Coarse sizes wear the feeder, overload and clinker on the grate. Preferred size is ¾ in. x 0, nut and slack.

Size consist *must* be uniform. Segregation of coals can raise hob with the usual thin fuel bed. Avoid it by (1) maintaining hopper half full at all times (2) filling hoppers by mechanically operated spouts, traveling larries or nonsegregating chutes.

So much for fuel and feed, now for firing. Fuel-bed thickness, grate speed, forced draft vary with steam demand and the particular coal. For instance, a high-ash low-fusion-temperature clinkering coal requires even distribution, uniform size consist and thickness on a thin, undisturbed fuel bed.

In general, keeping the fuel bed level and thin gives good performance and low maintenance. Good controls help achieve this. A heavy fire clinkers and smokes. Avoid particularly a heavy fire at front or bridgewall. At the front it causes overheating of arch, and at the bridgewall clinkering develops.

Ignition. Spreader stokers as a class enjoy the reputation of quick starters. Even with a cold setting, pressure builds up fast. So much so that it may exceed the rate considered safe for expanding parts of the boiler. It follows that the spreader-stoker fire comes up quickly on a live bank. But banking is something of a problem.

Be sure to leave a layer of ash on the grate. Cut down air flow, reduce feeder speed and supply coal to banking end only. Cut off forced draft and stoker speed. Maintain a slight overfire draft. On low-load operation, remember rate of ignition drops, smoking can develop.

How about draft? Air at low pressure and at temperatures below 300 F (to avoid any coking problem) passes through the grate. Overfire draft is deliberately held low to prevent development of troublesome gas velocities. Air introduced by jets (see below) at the overfire level is usually held down to 10-20% of the total supplied for combustion. Its function at this level is one of mixing. Steam jets achieve essentially the same result.

A low overfire draft and low gas velocity improve operation. Here is why. The thin fuel bed offers little resistance to incoming air so cinder and flue dust are ever present in the furnace gas, and more so with high drafts. Somewhere between 30-50% of the ash content of the coal goes off with the gas stream leaving the furnace. Furthermore, combustible in this same flyash-and-cinder mix constitutes as much as 50% of its weight. It all points up the need of (1) low drafts (2) a cinder collection and return. With some, collectors are imperative.

Cinder Reinjection. This system comprises (1) settling chambers somewhere within the boiler setting (2) a cinder collector usually before the induced-draft fan to save wear and tear on fan blading. All matter collected in the system is fed by mechanical means to the furnace for reignition and burning.

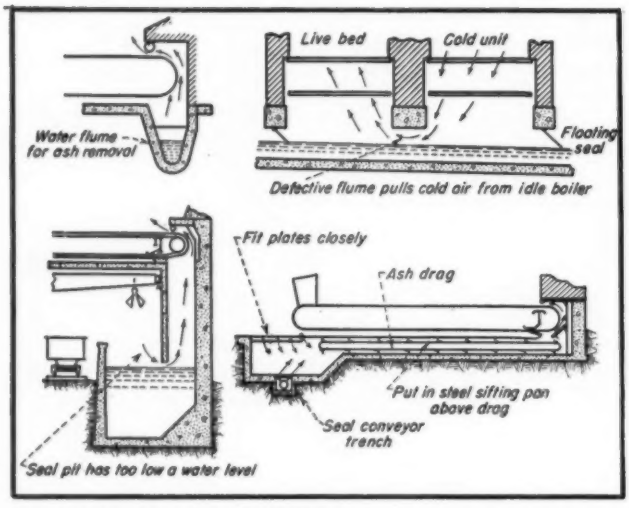
Returning cinder usually enters at a point above the fuel bed (but not too close to the boiler tubes) under the impulse of air or steam jets. These jets give an added overfire turbulence that promotes good combustion.

One operator in a large power plant believes in mixing the collected fines with the incoming coal in the stoker hopper. This procedure has two operating advantages: (1) uniform fire bed (2) reduction of fines in suspension by holding the recirculated dust at fuel-bed level.

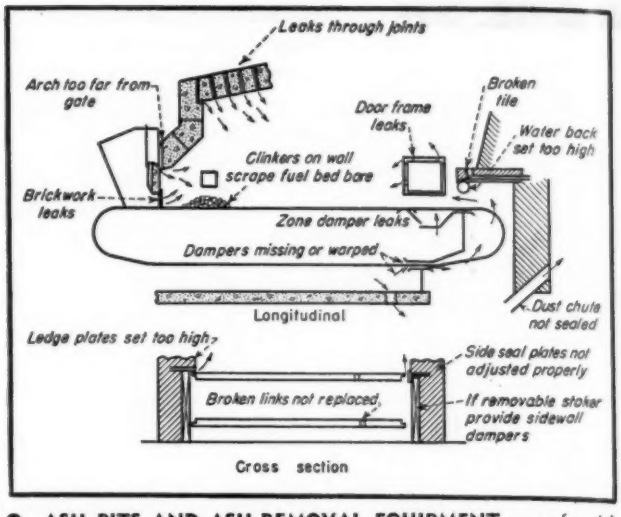
Recirculation of cinders and flue dust has strong advantages: (1) reduces stack discharge and, therefore, "the smoke nuisance" (2) increases over-all efficiency of the individual steam generator (3) reduces maintenance on induced-draft fan, rotor and casing. These advantages apply to traveling- and chain-grate as well as to spreader-stoker installations.

We are now ready to score the points where smoke trouble could develop.

First fuel supply. Here size consist


Live bed
Cold unit
Water flume for ash removal
Floating seal
Defective flume pulls cold air from idle boiler
Fit plates closely
Ash drag
Put in steel sifting pan above drag
Seal conveyor trench
Seal pit has too low a water level

2 **AIR LEAKAGE CAN UPSET** furnace balance, reduce steaming capacity, impose a heavier load on any draft fans used



3 **ASH PITS AND ASH-REMOVAL EQUIPMENT** may furnish convenient leakage paths for outside air to get into furnace

and segregation are the chief trouble sources. If percentage of coarse pieces is too high, they wear the feeder unduly, and later clinker on the grate. Clinkers upset the fuel bed—in extreme cases enough so to give a smoking fire.

Too high a percentage of fines places too much of the fuel in suspension for furnace volume and available combustion time. The result is heavy carryover of flue dust to atmosphere.

Next, firing itself. Keep a thin level fuel bed. A heavy one clinkers and smokes. Hold forced and overfire drafts to values consistent with a slight negative furnace pressure. Too strong a forced-draft or underfire air flow can blow holes in the thin fuel bed. Too high an overfire draft can lift cinders and fines off the fuel bed into the gas stream.

Clean fire pits and ashpits at regular intervals. Siftings in ashpits, once ignited. can damage grates. From then on, control of air flow is lost.

Last, furnace factors. Enough volume should be available to hold heat release to about 35,000 Btu per cu ft. Except for very small installations water cooling of furnace walls is a highly practical way of controlling heat release. Some method of inducing turbulence among furnace gases is necessary with the "open type" of furnace. Air or steam jets prove very practical.

TRAVELING AND CHAIN GRATES

The traveling-grate stoker was originally developed for small-sized anthracite but it differs only in structural details from the chain-grate design, once reserved for bituminous. As far as operation goes both perform the same function and in many instances serve side by side.

General Operation. Coal delivered by gravity from a hopper located above the moving grate passes under a stoker gate to enter the furnace proper. This gate can be raised or lowered to permit varying fuel-bed thickness.

Ignition begins at the top of this fuel bed. Coal burns down as the grate progresses from front to back. Any unburned combustible in the thinning fuel bed by the end of the grate travel is dumped into an ash hopper.

Ignition. Let's look more closely at the important problem of ignition. For any moving-grate installation rate of ignition controls grate speed and fuel-bed thickness.

Incoming coal on the surface of the fuel bed has its temperature raised by radiation largely. Once it ignites, it warms by contact those coals lying beneath the surface.

If the rate of air flow through the fuel bed is about right these surrounding coals proceed to ignition in short order. If air flow (including leakage, see Fig. 2 and 3) is far more than needed, the over-all result is a cooling of the fuel bed. In short, a slower ignition rate.

But once ignition is under way the gas coming off the fuel bed differs from section to section in the furnace. Let's divide the furnace in three zones: (1) The part where most volatile matter is distilled off, usually occurring early in the coal's furnace travel. Furnace atmosphere in this region is a "reducing" one—the gas is "rich" in combustible volatiles but lacks enough air (2) The most active burning area. Here the mixture of air and combustible is nearest to ideal. (3) Rear zone where the last chance for consuming unburned combustible occurs. It is a zone heavy with excess air. Unless some means exists of bringing these three, highly different gas mixtures together they may leave the furnace in layers, called stratification. Whatever mixing the furnace baffling gives is too late since it occurs up in the boiler passes.

Two methods are commonly used for mixing gases in the furnace (1) arches (2) overfire jets.

Arches. Early design employed a front spring arch, Fig. 4, about 2 ft above the grate. It ran almost two thirds of the grate length. The reasoning behind this arch was an attempt to increase the radiant-heat surface over the fuel bed. But then came the principle of forced draft with controlled zones. Furnace design changed. The low overhanging arch in the front of the furnace was greatly shortened to become the "ignition arch." Then along came a second arch, the rear one. It owes its presence to the desire for better gas-air mixing—the prevention of stratification (see above). The bridgewall in early installations became an overhanging one and finally grew into a full-sized rear arch, to form the so-called "throat" common to many chain and traveling-grate stokers.

This rear arch serves an important operating function. It provides a means of channeling the rear-area excess air into contact with the rich furnace gas forming over the most active burning area towards the front.

The rear area provides the last chance for consuming all remaining

combustible. Any that passes beyond this point is lost to the ash hopper. So for this reason a heavy flow of excess air is usually admitted through the last zones. If this excess can be channeled it provides some of the air needs in the "rich" section and reduces the over-all excess air.

It must be remembered that ash particles swept up in eddies settle out on furnace surface. They tend to sinter or fuse into clinkers. If they accumulate under arches or along the furnace sides they either shear stoker pins or sweep bare the grate bars to the furnace heat, Fig. 3.

Overfire Jets. If chain- or traveling-grate stokers were to operate at only one rating a furnace employing only arches for mixing could be designed to give optimum turbulence. But almost every installation operates over a range of load. To produce a combination of arches that successfully spans the usual load range is a difficult assignment.

For this reason the overfire jet has come in as a supplementary mixing element. There are, in fact, operating units that have little or no arch construction at all. Overfire jets provide the only mixing within the furnace. But what about the all-important item of air supply?

Air Flow. Amount and control of air entering the furnace of any coal-fired unit directly affects ignition. The air enters at one or both of two points, overfire or underfire.

Natural-draft and forced-draft units introduce air under the fire except for air leakage through furnace setting, observation points, etc, above the fire. Jets often serve as supplementary ports for overfire air with bituminous coals.

Leakage in a natural-draft furnace may seriously reduce steaming capacity. If it occurs at the combustion chamber level it breaks down the pressure difference across the fuel bed. This drop in "pull" through the resistance of the fuel bed lowers the ignition rate. In forced- or induced-draft units similar leakage puts a heavier load on the fans. Some of the ways in which leakage may develop show in Fig. 2 and 3.

Air sealing along the stoker length is highly important. Air enters under the grate through windboxes at different pressures along the stoker length. A low air pressure along the side walls beneath the grate helps keep out air infiltration where fuel-bed resistance is lowest.

Sizing and Segregation. Natural-draft stokers usually have about 20% air space in the grate. They operate with 0.1 to 0.5 in. draft loss through the fuel bed. Below 0.1 in., draft invites heavy heating of grates. Over a half inch sets up too high a gas velocity with attendant cinder and flue dust carryover as well as increased setting leakage.

With a low draft, 0.1 to 0.15 in., use coal with a top size of 1¼ in. and little fines below ½ in. A heavier draft permits coal of 1½-in. to the range of fines naturally occurring from crushed lump coal.

Forced-draft chain grates have 7 to 10% air space in the grate. Coals with an increased percentage of fines and a smaller top size, ¾ to 1 in., can be fired. Problems from siftings passing through the grates are lessened because of the smaller grate air space.

Draft loss across the fuel bed is of the magnitude of 1½- to 2-in. drop. With this condition of fuel bed the smaller top size, ¾ to 1 in., burns to a clearer ash than would be the case with coarser sizes above this range.

Class of Fuels. Chain- and traveling-grate stokers have long been considered suited for high-ash free-burning coals. The reasoning behind this is that the fuel moves in one plane, free of agitation. Coking coals, it is felt, tend to mat over, cut off air supply, increase fuel-bed resistance.

Low-ash coals may burn out to expose the rear section to furnace heat. Water cooling of parts in this area extends possible range of fuels.

These stokers have the reputation of being highly practical for anthracite firing. They can also fire a lightly coking coal and coke breeze. One recommended method admits considerable air at the front or entrance of the fuel bed. This distills off the tarry, volatile constituents quickly before individual coal particles coalesce.

Sources of Smoke. Let's review the chain- and traveling-grate stoker as we did the spreader for smoke-trouble spots.

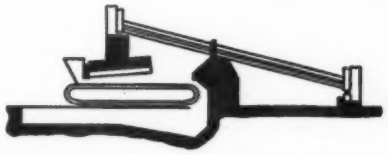
Fuel Supply. Again, size consist and segregation are important to smokefree combustion. They affect all stoker firing in the same manner as discussed under the spreader stoker section.

Firing, to be good and smokefree, follows again the precepts of even fuel bed, low overfire draft, control of air flow.

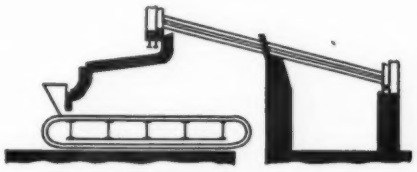
Cleaning fire and keeping ashpits free of siftings are very important. Warping of grate surface and windboxes can develop from a neglect of siftings in the ashpit. Once these metal parts warp control of furnace air is almost impossible.

Furnace Factors. Make certain your furnace has adequate volume for the coal you are now firing. Many arch-constructed units have very limited volume. A change of coal can very well give a smoking installation. Over-fire turbulence helps this condition but does not entirely cure it. Jets, where they apply, may improve existing turbulence within a given furnace.

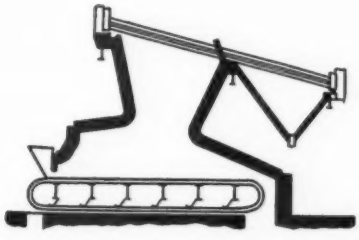
4 MOVING GRATES



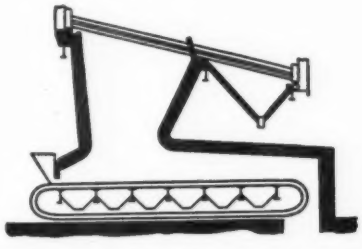
Early sprung-arch overhung furnace



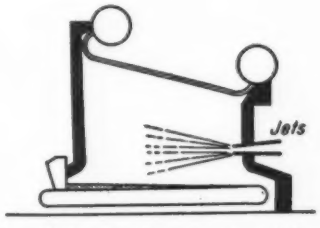
Ignition arch makes its appearance



Gas-air mixing produces the "throat"



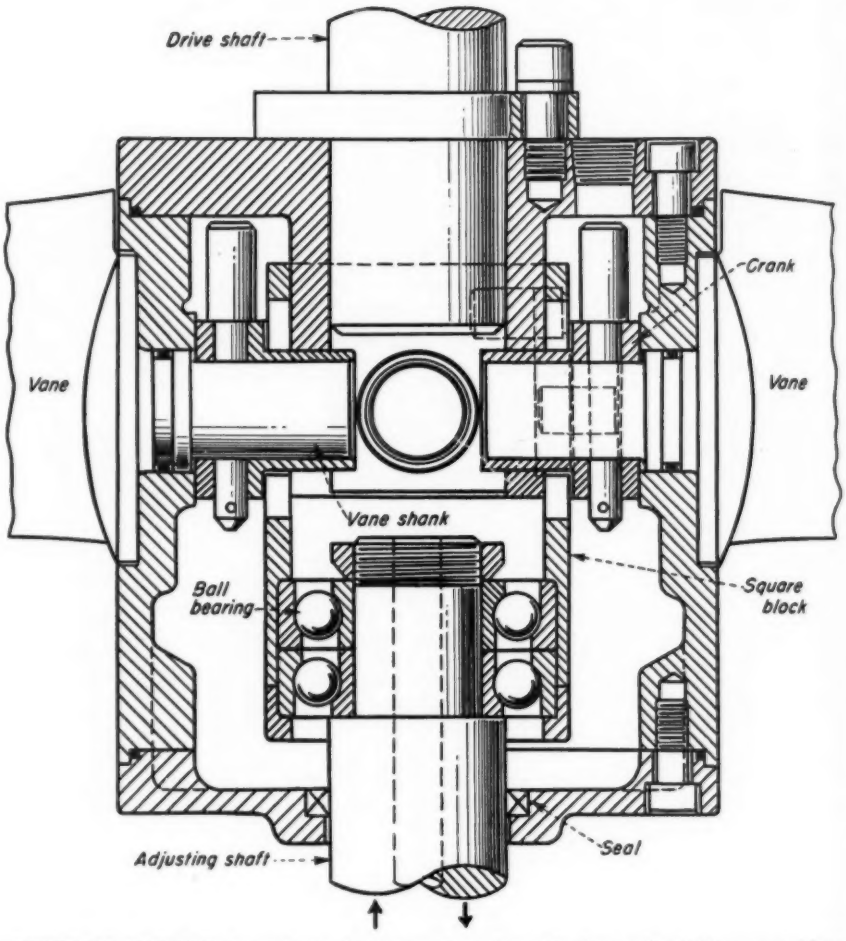
Long rear arch gives more volume



Jets help develop gas-air mixing

Adjustable Vanes Match Pumps

Axial-flow 22,000-gpm impeller pumps serve condensers in central station over wide range at high efficiency, reduce pumping power and condenser maintenance. Pump construction, test performance reported by A J Stepanoff, engineer, Ingersoll-Rand Co



VERTICAL SECTION through the hub of an impeller with four adjustable vanes. Vane position is adjusted from below the impeller by moving the adjusting shaft up or down

▶ WHERE CONDITIONS REMAIN constant it is comparatively simple to select a pump to suit the application. But many pumping requirements vary—some over wide ranges—and must be met by any one of several methods. For low-head applications, adjustable-vane propeller pumps are used to meet changing operating conditions.

Pump Capacity Changes. In general, pump-capacity changes are needed because of:

1. Changes in static head. These frequently occur with low-head propeller pumps that take their suction from or discharge into rivers, lakes or the sea. Here, to keep pump capacity constant, changes in impeller performance are required at different heads.

2. Changes in pumping demand. Applications of this kind are condenser circulating cooling water, where required pump capacity varies with load on a steam turbine and temperature of the cooling water.

3. Changes in suction supply. These occur in such applications as storm-water, sewage and drainage projects.

When a centrifugal pump is driven at constant speed, its capacity is generally regulated by throttling its discharge. This requires a pump big enough to supply maximum demand at the head existing at that time. At other than these conditions part of the pump's capacity and power is wasted. An oversized motor is usually required for the extreme operating conditions as compared with average normal requirements.

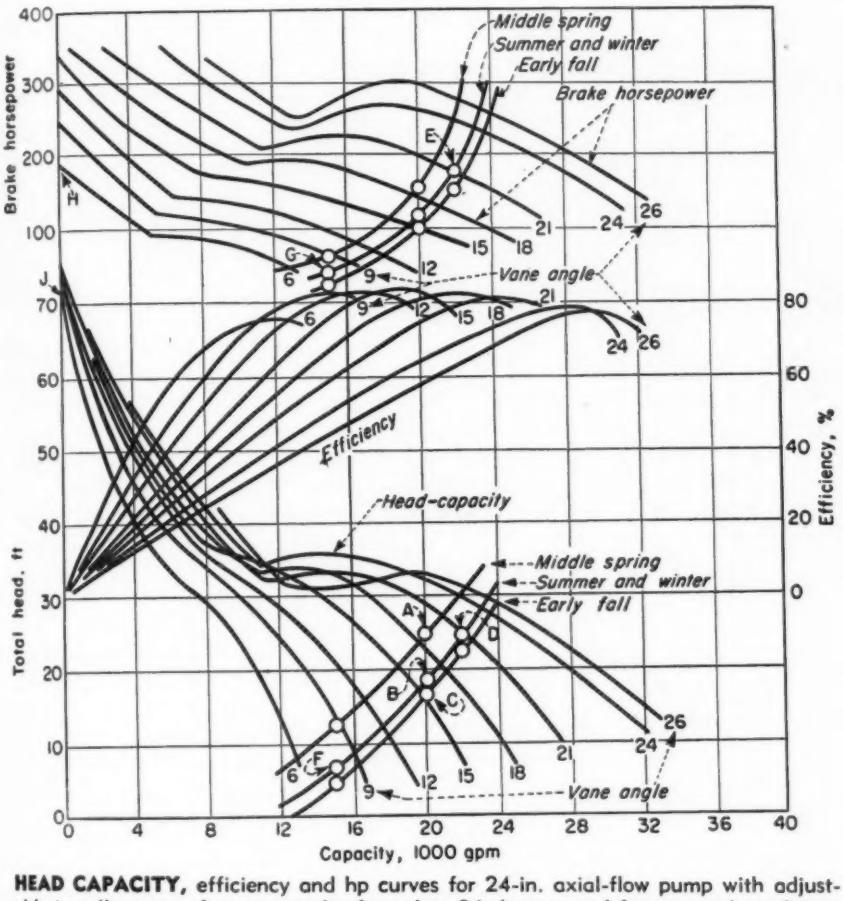
An axial-flow pump with an adjustable-vane impeller operating at constant speed is comparable to a centrifugal pump having a number of impellers, of different head-capacity characteristics, that can be changed at will.

Test Data on Pumps. Stone & Webster installed two of these pumps in the Rockford generating station of the Central Illinois Electric & Gas Co. Each supplies cooling water for a condenser, has a 22-in. impeller, a 30-in. discharge column and elbow, and is driven at 880 rpm by a 200-hp hollow-shaft induction motor. These pumps have been in operation over a year. Test data here presented were obtained from a 16-in. model with a 14.25-in. impeller operated at 1160 rpm.

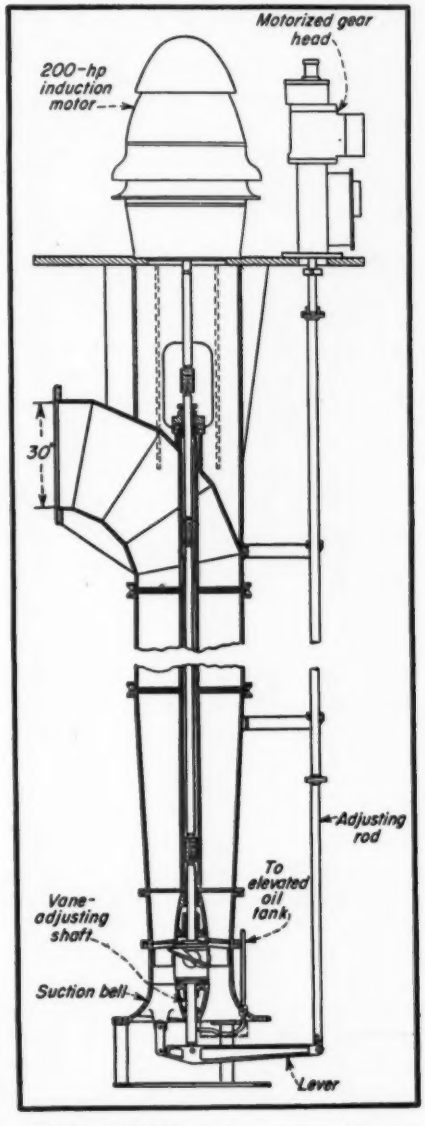
Drawing on facing page shows a cross section of the complete pump and its impeller-vane adjusting mechanism. In conventional designs, the vane-adjusting rod passes up through a hollow pump and motorshaft to the unit's top. In this figure a short vane-adjusting shaft extends downward from the impeller to a lever attached to the suction bell. This lever is actuated by an external adjusting rod. Above the impeller, pump parts and motor are standard units, such as are used with fixed-vane impeller pumps. Impeller vanes are adjusted by a motorized gear head remotely controlled from a push-button station. An electric indicator shows vane position.

Drawing above shows a vertical section through the hub. The shank of each vane is supported in a bearing in the hub's outer shell and in the inner hub, the latter being part of the hub's upper cover. Short cranks on the vane shanks connect by links to a square block, which surrounds and is guided by the inner hub. The adjusting shaft through a duplex ball bearing moves the square block up or down to position the vanes.

To Operating Requirements



HEAD CAPACITY, efficiency and hp curves for 24-in. axial-flow pump with adjustable-impeller vanes for vane angles from 6 to 26 degrees and for seasonal conditions



CROSS SECTION, 24-in. pump: how external-adjusting rod positions the vanes

The hub assembly rotates while the adjusting shaft has a reciprocating motion only. In the hub's lower cover a seal around the adjusting shaft keeps water out of the hub, which is under oil pressure applied through a hole in the adjusting shaft, diagram at right.

A pipe connected to an elevated tank keeps the impeller hub filled with oil at a pressure exceeding the water static head. Maintaining the hub full of oil under pressure holds the packing to its seat and insures that any leakage will be oil out of the hub, and not water into it. Loss of oil from the elevated tank indicates condition of the hub seals.

Curves above show performance of the 24-in. pump based on tests made on a 16-in. model. As the pumps are installed in the plant their intake level is lower than the condensers' outlet level; consequently, they have to operate against some static head in addition to the condenser flow resistance.

As shown on the curves, system characteristics vary with the seasons. For instance, in middle spring, at 20,000 gpm total head is 25 ft, point *A*. In summer and winter total head drops to 18 ft, point *B*, and in early fall it is 16 ft, point *C*. Points marked on the head-capacity curves are those fixed by the specifications and have to be met for various loads and head conditions. Over practically the whole useful range of operation the efficiency is 80% or more.

Brake-horsepower curves show power savings at reduced capacity. For instance, during summer and winter operation, at a discharge of 22,000 gpm and 25 ft head, point *D*, the pump requires 175 hp, point *E*. At 15,000-gpm discharge and 7-ft head, point *F*, power required by the pump drops to 40 hp, point *G*.

Figures given at the ends of the curves indicate impeller-vane angles from the horizontal. These angles run from 6 to 26 deg. For 22,000 gpm and 25-ft discharge the blade angle is 21 deg; for 15,000 gpm at 7-ft head, blade angle is reduced to about 8 deg.

Load on the condenser and cooling-water temperature determine the amount of pumping capacity needed. Power saving at part load and increased life of condenser tubes were the reasons for selecting adjustable-vane impeller pumps. For a given installation, life of condenser tubes varies inversely

(*Continued on page* 136)

SPEAKING OF POWER

Correspondence with POWER readers in foreign countries is always interesting and sometimes has a peculiar charm. We have never forgotten one communication from South America, apparently laboriously produced by consulting a dictionary for the literal English equivalent of each Spanish word. It was evident that the writer wanted help, that he wanted to know where he could buy something. What had us licked was what he said he wanted—a "male water sheep." Finally one of the smarter editors (now on the business staff and headed for a vice-presidency or something) came up with the answer; our friend wanted a *hydraulic ram.*

★ ★ ★

Joe Van Denburg, McGraw-Hill World News man on the India beat, reports from Ceylon that cocoanut oil pinch-hit successfully for diesel oil when a flood recently upset fuel deliveries in parts of the island. Since then researchers have studied cocoanut oil's properties, and find it a safe and practical fuel for slow-speed engines if preheated to 120 F before injection.

★ ★ ★

British interest in the gas turbine as a stationary power unit is demonstrated by two recent reports. The Central Electricity Board has ordered installation of a 15,000-kw oil-fired open-cycle plant at Trafford Power Station, which now contains 60,000 kw of steam capacity with 30,000 more being added. To be built by Metropolitan Vickers, the gas-turbine unit is expected to operate at a thermal efficiency equal to that of Britain's best steam plant. (Battersea Station registered 26.5% in 1946, based on units sent out.)

Toward the end of last year, John Brown and Co, British licensees of Escher Wyss, started construction of a 12,500-kw closed-cycle gas-turbine plant. This will resemble in many respects the plant of the same size being built by Escher Wyss for Gennevilliers Power Station, near Paris.

★ ★ ★

Marine development is never very far from the British mind and the gas turbine is no exception. British Thomson-Houston Co is installing a 1200-hp 2-shaft gas turbine in a tanker, where it will operate in conjunction with existing diesels. A 3500-hp marine unit, arranged to reverse by means of hydraulic couplings in the reduction gearing, is under construction by the various companies united for gas-turbine development under the name *Pametrada* (Parsons and Marine Engineering Turbine Research and Development Association). Further reports have it that John Brown and Co is working on a closed-cycle plant for a Channel steamer. It is understood to be a twin-screw plant, 6000 hp on each.

★ ★ ★

Drilling contractors in the oil fields of the Southwest now turn to a mobile laboratory for water-treatment service. Making the rounds of the rigs, the truck crew analyzes boiler-water conditions on the spot, to arrive at a tailor-made treatment, or to check the results of previously prescribed dosage. The same truck delivers treating chemicals ready for use.

★ ★ ★

Reader John S Kernachan says, "This I gotta see," about a statement in a used-machinery ad in the January Searchlight section of POWER. It read "1000-kw Westinghouse 250-volt *514-rpm* generator *direct-connected* to *3600-rpm* Westinghouse bleeder condensing turbine." We'd like to see it, too.

★ ★ ★

Although we usually think of insulation as keeping the heat from leaking into a refrigerator, it's a good idea sometimes to remember that it works both ways. For example, refrigerator cars bound East from the Coast could profit from the cold air in the mountains, which the insulation nicely shuts out. Operating regulations are being relaxed to make it possible to take advantage of this "free cold."

★ ★ ★

Graduate engineers in the Detroit area are to have their own "university" staffed by practicing members of the profession, and it is expected that this pilot operation will be followed by others in key cities of the country.

The Engineers Council for Professional Development is sponsor of the plan, which has been devised as a much-needed help to the young engineer in the early days of his career. Many authorities feel that it is in the first few years after leaving technical school that the engineer makes or mars his future.

ECPD, under its chairman, James W Parker, president of Detroit Edison Co, will work with Detroit's local engineering society and its affiliates, which comprise some 30 local sections of national engineering societies. The "university" will sponsor courses, lectures and guidance consultations for engineer graduates. "Regents" of the new university will be past presidents of the society, and outstanding engineers of the community will serve on its faculty.

★ ★ ★

Use of high-temperature high-pressure water instead of steam for process heating has been advocated for a variety of reasons and tried out in a number of plants in this country and abroad. Right now, fuel-short Australia is enthusiastic about the savings possibilities. A complete high-temperature high-pressure water plant has been installed in the new textile plant of James Miller & Co, at Warragul, Victoria, and a similar plant is in operation in a knitting mill at Richmond, Victoria. Temperatures as high as 350 F at 120 psi are used. In addition to making it possible to transmit more heat per unit volume than with steam, fuel savings as high as 30% are claimed.

THIS MONTH'S COVER

As atomic scientists launch a research program to learn more of the mysterious forces that keep particles in the nucleus from flying apart, Dr William E Shoupp, directing the project at Westinghouse Research Laboratories, checks up on the "atom smasher." In the cover photo, he is using a mass-spectrometer detector to make sure there are no leaks in the 40-ft vacuum tube down which the atomic bullets travel before they smash into the target.

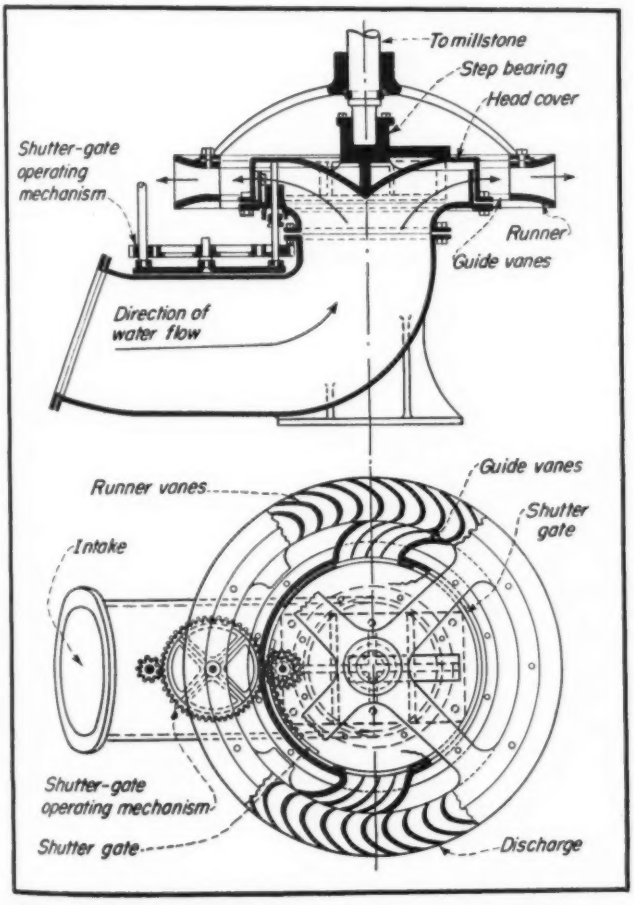
Helium is sprayed from a hose along every inch of the quarter-mile of surface joint in the vacuum tube. If there is a leak, helium enters the vacuum system and activates a special electronic tube, which is preset to "sniff out" helium. The detector can reveal a leak of air so tiny it would take more than 3000 years to deflate an automobile tire.

OPERATION. Looking down, from above, on waterwheel when water is discharging from its buckets

PLANT SITE. Two 100-year old turbines are installed in flour mill owned by a farmer. Building is about six miles from Trollhattan, Sweden

Waterwheels Operate 100 Years

By **GEORGE WILLOCK,** *Trollhattan, Sweden*



TURBINE CROSS SECTIONS. Water enters this turbine from underneath. It passes through the shutter gates and the guide vanes, then discharges horizontally through the runner buckets

▶ ONE HUNDRED YEARS of service to industry is a noteworthy record for any company. But it assumes even more significance when the first two waterwheels it constructed are still in service, as with Nydqvist & Holm, of Trollhattan, Sweden.

In 1848 a farmer installed these turbines to drive a flour mill. Compared with a modern installation, the waterwheels are of unusual design. Photo above, at left, shows one of them in operation, and photo at right shows the mill on one side of the stream.

These turbine parts are arranged in reverse to the parts of a modern unit; that is, the outer part is the runner, and the inner, the stationary guide vanes and gate mechanism.

As the drawing shows, the runner connects to a vertical shaft that drives the millstone. Lower end of this shaft runs in a lignum-vitae step bearing, supported on the head cover. There are five stationary guide vanes, in each of two openings on opposite sides of the fixed element. Size of openings is controlled by shutter gates, positioned from a handwheel on the operating floor.

Vane Operations. When the shutters are open water passes through, between the stationary guide vanes, then to the runner, causing it to revolve. Turbine output depends on the number of openings between the stationary vanes uncovered by the shutter gates.

When the gates are fully open, eight jets, four on each side, flow into the runner, which then develops 20 hp at 150 rpm under a 9-ft head. The well-formed vanes of the waterwheels look more like those of a modern steam turbine than a 100-yr-old waterwheel.

In celebrating its hundredth anniversary Nydqvist & Holm presented medals to 464 employes with more than 25 years service. Seven had 57 years of unbroken service, and eleven had 50 years. Of the 2000 employes nearly 25% have been employed 25 years or more.

Investigate the RILEY

These companies have ordered Riley Traveling Grate Spreader Stokers

COMMONWEALTH & SOUTHERN CORP.
for Ohio Edison Co., Akron, Ohio
2—16'0" x 15'0"; 2—90,000 lbs./hr. units

CITY OF PROVO, UTAH
1—16'0" x 17'0"; 1—100,000 lbs./hr. unit

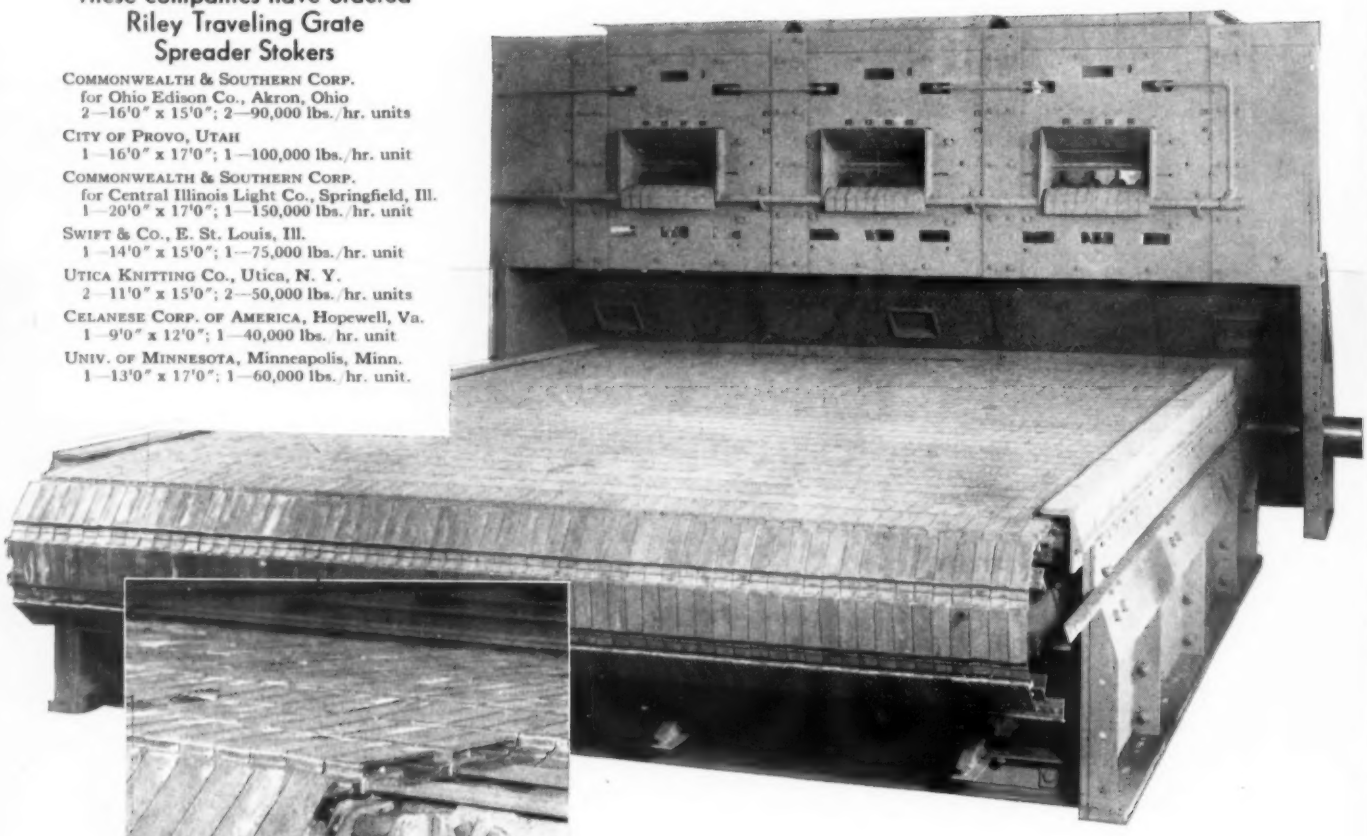
COMMONWEALTH & SOUTHERN CORP.
for Central Illinois Light Co., Springfield, Ill.
1—20'0" x 17'0"; 1—150,000 lbs./hr. unit

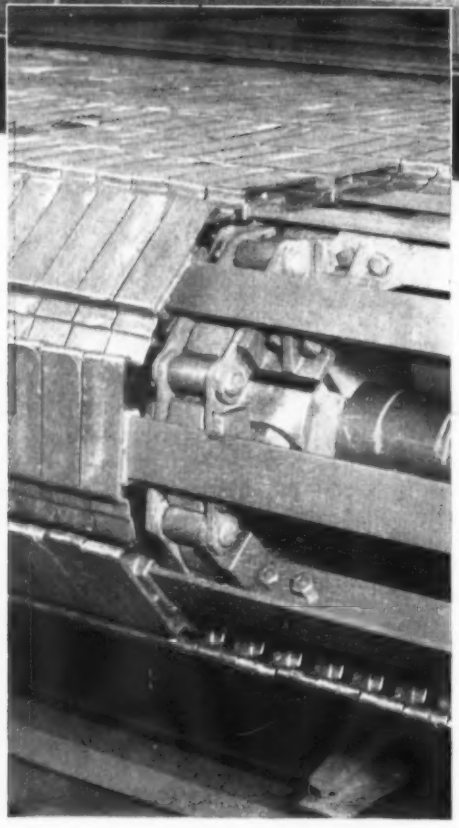
SWIFT & CO., E. St. Louis, Ill.
1—14'0" x 15'0"; 1—75,000 lbs./hr. unit

UTICA KNITTING CO., Utica, N. Y.
2—11'0" x 15'0"; 2—50,000 lbs./hr. units

CELANESE CORP. OF AMERICA, Hopewell, Va.
1—9'0" x 12'0"; 1—40,000 lbs. hr. unit

UNIV. OF MINNESOTA, Minneapolis, Minn.
1—13'0" x 17'0"; 1—60,000 lbs./hr. unit.





Backed by over 50 years of stoker manufacturing experience

The stoker engineering experience of the Riley Stoker Corporation dates back well over 50 years to the Murphy Furnace and the Jones Underfeed Stoker, two of the first commercially successful stokers. Riley is also one of the oldest manufacturers of the traveling grate stokers and its affiliated companies have been manufacturing spreader stokers for over 15 years. With the development of the Riley Traveling Grate Spreader Stoker,

TRADE MARK Rx REGISTERED

RILEY

STOKER CORPORATION, WORCESTER, MASS.

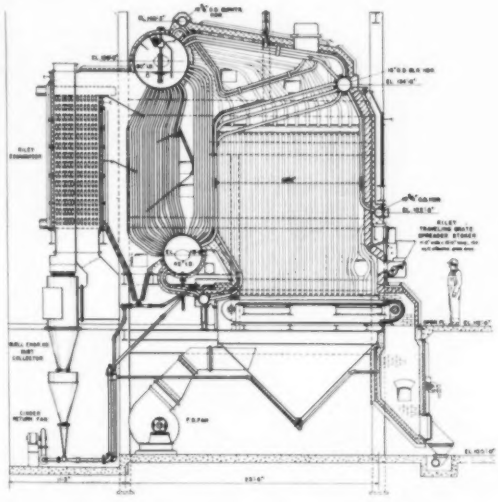
Boston New York Philadelphia Washington Buffalo Cleveland Detroit Chicago St. Louis Cincinnati St. Paul Pittsburgh Kansas City Denver Seattle Portland Los Angeles Houston New Orleans Atlanta Memphis

BOILERS • PULVERIZERS • BURNERS • STOKERS • SUPERHEATERS • FLUE GAS SCRUBBERS

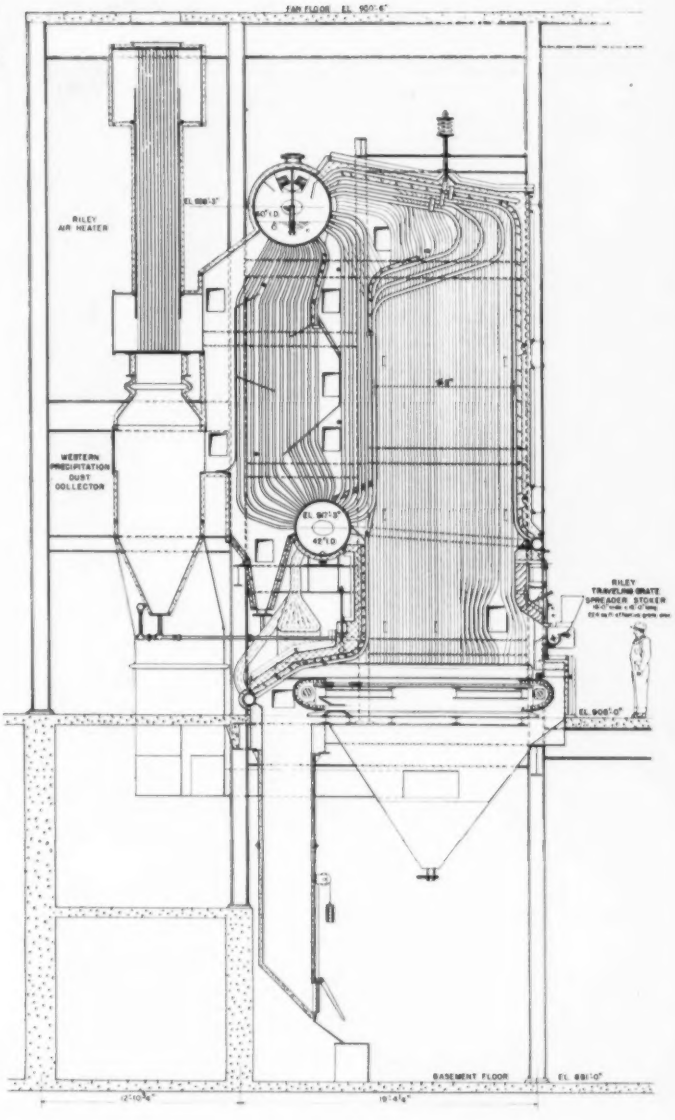
traveling grate spreader stoker

Riley is in a position to offer you any and all types of coal burning equipment, including all types of stokers and two types of coal pulverizers.

Your investigation of Riley Traveling Grate Spreader Stokers will indicate to you the many distinctive advantages in construction and operation resulting from the extensive experience of the Riley Stoker Corporation. We believe you will agree that the Riley Traveling Grate Stoker is the outstanding stoker of this type. It will pay you to keep your eye on Riley in the spreader stoker field. Riley users will tell you, "you can rely on Riley."



UTICA KNITTING CO., Utica, N. Y.
Gibbs & Hill, Inc., Consulting Engineers
2—50,000 lbs./hr.—400 lbs.—490°F.
These units consist of Riley boiler, water walls, steel-clad insulated setting and economizer, fired by Riley Traveling Grate Spreader Stoker.



OHIO EDISON CO., Akron, Ohio
(Commonwealth & Southern Corporation)
2—90,000 lbs./hr.—250 lbs. Riley Units
These units consist of Riley boilers, water walls, steel-clad insulated setting and air heater, fired by Riley Traveling Grate Spreader Stokers.

A survey of your power plant by a consulting engineer will possibly show ways of making surprisingly large savings in your power costs

COMPLETE GENERATING UNITS

. . . it will pay you to visit modern Riley Installations before purchasing Boiler or Fuel Burning Equipment

ECONOMIZERS • WATER-COOLED FURNACES • STEEL-CLAD INSULATED SETTINGS • AIR HEATERS

SOUTHWARK STATION STARTS Continued from p 68

ment is the oilless type. Each 10,000-kva transformer bank consists of 3 single-phase air-cooled transformers. The unit-type substation transformers, lighting transformers and lighting regulators are natural-draft, air-cooled. All circuit breakers for 4-kv and lower voltages are air breakers of the draw-out type.

In all station lighting, past experience and the newer developments were carefully considered. One significant change has been the use of cold-cathode lighting for the administration section of the building, control room and the switch house. Turbine room and heater bay have high bay-type units using twin mounting of incandescent lamps and 400-watt mercury units. Dust-tight incandescent units are used in the boiler room.

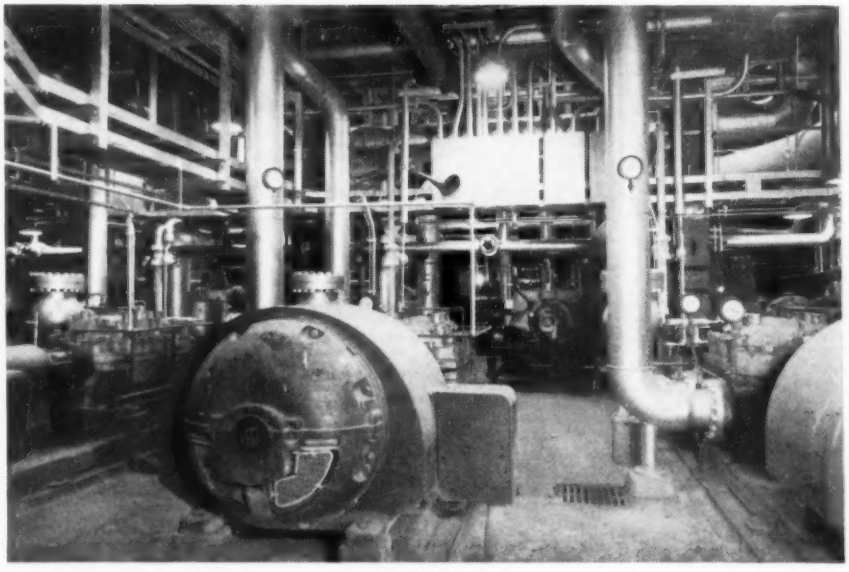
Building. Exterior walls are red brick with glass block windows. Louvers are placed where admission of outside air is needed. Interior walls are glazed brick. Main building and major equipment on the ground floor are supported on concrete-filled piles, bearing in a gravel stratum about 50 ft below grade. Structural frame is steel, fireproofed where needed. Grating has been used considerably for flooring for economical reasons and better ventilation and lighting.

Construction of coal tower and screen house matches that of the main building, except the piles, which are the standard wood type used for piers with the cut-off below mean tide.

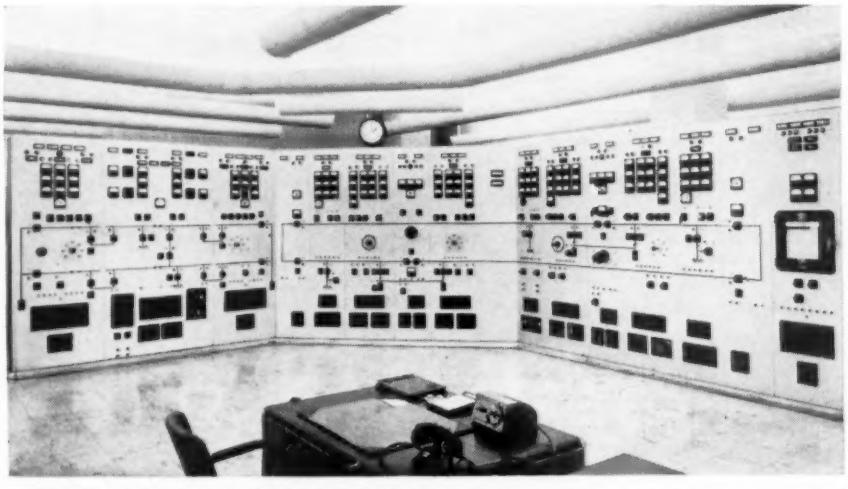
Wash and locker rooms are mostly centralized on the 2nd and 3rd floors of the building's administration section, which is nearest the entrance gate and most convenient for men coming to and from work. This arrangement gives better accommodation with a smaller amount of equipment and at a lower cost than do several locker rooms. Toilet facilities are distributed conveniently throughout the buildings.

The small utility rooms represent a new step in Philadelphia Electric Co station layout. They offer better eating conditions, at six points in the main building and at one point in the coal tower. Each room provides shift men with a refrigerator, hot plate, coffee percolator and a 4-section storage cabinet for supplies and utensils.

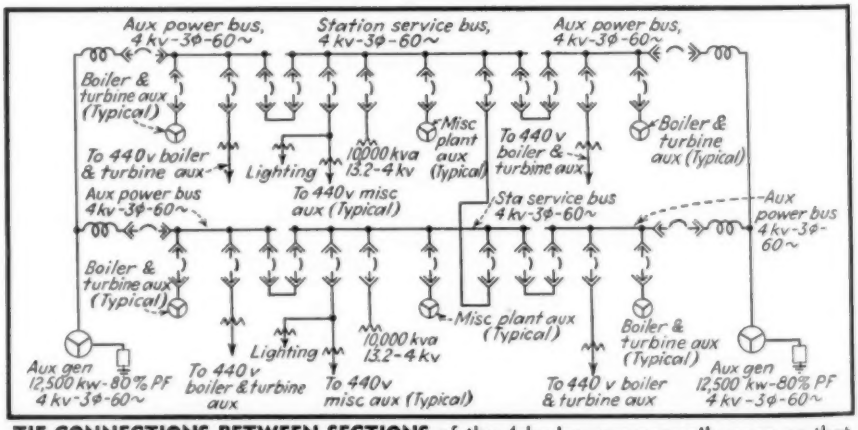
In addition to telephones a public address system is installed for operation and paging.



BOILER FEED PUMPS ARE CENTRALLY GROUPED, three low-pressure motor-driven pumps are in foreground with one of three high-pressure pumps visible in the rear



STATION ELECTRICAL CONTROL ROOM houses both high- and low-tension control boards, 4-kv auxiliary power board at left, 13.2-kv main power board at the right


Aux power bus, 4 kv-3φ-60~
Station service bus, 4 kv-3φ-60~
Aux power bus, 4 kv-3φ-60~
Boiler & turbine aux (Typical)
To 440 v boiler & turbine aux
Lighting
10000 kva 13.2-4 kv
Misc plant aux (Typical)
To 440 v boiler & turbine aux
Boiler & turbine aux (Typical)
Aux power bus 4 kv-3φ-60~
To 440 v misc aux (Typical)
Sta service bus 4 kv-3φ-60~
Aux power bus 4 kv-3φ-60~
Boiler & turbine aux (Typical)
Misc plant aux (Typical)
Lighting
10,000 kva 13.2-4 kv
Boiler & turbine aux (Typical)
Aux gen 12,500 kw-80% PF 4 kv-3φ-60~
To 440 v boiler & turbine aux
To 440 v misc aux (Typical)
To 440 v boiler & turbine aux
Aux gen 12,500 kw-80% PF 4 kv-3φ-60~

TIE CONNECTIONS BETWEEN SECTIONS of the 4-kv bus are normally open so that only one power source supplies each section during the usual operating conditions

1949 — Can Be a Good Year Too

You can expect good business to run on well through 1948.

But old-time competition is close upon us.

And 1949 will be a critical year for all of us — making lower taxation imperative NOW.

These are the main conclusions drawn from a nation-wide survey of industry's plans for new plants and equipment which McGraw-Hill has just completed. Here are the major findings:

1. Capital expenditures in 1948 may be a little lower — but at the most only 8% lower — than in 1947.
2. In 1949 capital expenditures may decline. 1949 plans are still fluid. However, those which have been projected now show a falling off. (Washington planners, please note: Current official attempts to discourage capital expansion may turn out to be superfluous — or downright dangerous.)
3. Industry's initial postwar rebuilding will be 85% complete at the end of 1948. When this first wave of deferred maintenance and expansion is finished, American industry will have more than half again the capacity it had in 1939. This does not mean the end of needed capital expenditures. Business will need to invest much more. (President Truman sets an investment goal immediately ahead of $50 billion.) But it does mean that tough competition is returning fast.

• IF YOU WANT *full details of the McGraw-Hill survey of Capital Expenditures, which is summarized in this editorial, write to the Economics Department, McGraw-Hill Publishing Company, 330 West 42nd Street, New York 18, N.Y.*

These are solid facts, based on plans which are firmly made by a broad cross-section of American industry and which the McGraw-Hill survey revealed.

The greatest contribution of this survey is the information it supplies on business plans for the purchase of new plants and equipment. What business planned to do about such expenditures was by far the biggest unknown element in the 1948 outlook. For, if business planned to slash its outlays for plants and equipment this year, that fact alone could bring a sharp downturn in business.

In making this survey, McGraw-Hill researchers all over the nation personally interviewed top executives of companies selected to make up a scientific cross-section of industry. Each executive was asked to give, *not his opinion* about general business trends, but *factual details* about his company's plans for 1948. By adding together the plans of the companies interviewed, McGraw-Hill has secured, for the first time, a reliable picture of what business plans to do in the months ahead.

Here are plans for 1948 and 1949, as revealed by the survey:

1. Industry still needs more than a year to finish its initial postwar maintenance and rehabilitation program.

Among manufacturing industries, top executives report that 64% of their program for the immediate postwar period is now complete. According to present plans, 85% will be installed by the end of this year even though some manufacturing industries still have a long way to go. For instance, oil companies will complete only three-quarters of their presently planned expansion program by the end of 1948.

2. Business may spend less on new plants and equipment this year than the record $16.1 billion spent last year. But the decline

probably will be negligible and certainly will not be great enough to bring on a business recession.

At the time McGraw-Hill interviewed top executives, some companies had not yet approved their 1948 capital budgets. Under the extreme assumption that those particular companies will make *no* capital expenditures in 1948, industry's 1948 bill for new plants and equipment will run to $14.9 billion, or 8% below last year's record figure. Under the more realistic assumption that those companies will cut their capital investment only as much as the companies which had already drawn up their plans for 1948, industry's 1948 capital budget will run to almost $15.8 billion, a decline of only $300 million from 1947.

Thus the over-all conclusion of the McGraw-Hill survey is that capital expenditures by business will be only slightly lower this year than last.

3. Business executives will not slash their 1948 capital budgets unless they are convinced that a real slump is in the offing—and they are not convinced now.

Almost two-thirds of all manufacturing companies say they would not cut capital budgets sharply even if business activity declined 20%. What is more, even a 15-20% boost in wage rates would have little effect on projected capital budgets. If wages go up, 57% of manufacturing companies would not change their capital budgets, 26% would increase them, and 17% would cut them.

4. Most executives look for an increase in their company's sales this year.

More than half of all manufacturing companies are planning on a sales increase over last year of 10% or more. A third of them say sales will be about the same as in 1947. And fewer than 10% look for lower sales.

5. Manufacturing companies will finance much of their purchases of new plants and equipment in 1948 from funds set aside out of past or current earnings.

Utilities and railroads, on the other hand, must go to the securities markets or commercial banks to finance most capital expenditures.

Although manufacturing companies say they can finance this year's capital expenditures in large part from current profits and past savings, all evidence indicates that, to do so, they will use up most of the funds they earmarked during the war for this purpose. So in 1949, industry must go to the capital markets or to the commercial banks if it is to continue to spend for capital purposes. If the securities markets continue to lie in the doldrums, *as they will under present tax laws,* only companies with triple A credit ratings will be able to raise funds that way.

6. Purchases of new plants and equipment may fall off in 1949.

The McGraw-Hill survey collected all available evidence on plans for 1949 capital budgets. Fewer than 40% of all manufacturing companies now have definite plans for 1949. Of those that have plans, 45% intend to spend less than in 1948, 30% plan to spend the same amount, and a quarter expect to spend more. These preliminary decisions would seem to indicate that capital investment may fall off in 1949.

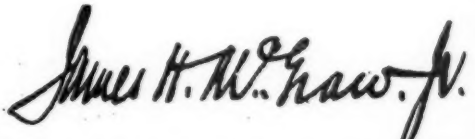
7. Industry's production capacity in 1949 will be far above prewar.

Manufacturing capacity will be more than 50% greater than in 1939 once the present wave of postwar building is complete. Almost a third of all manufacturing companies report that their capacity will be double or more than double the prewar figure. Thus, 1949 may see a huge increase in production of many things that now are hard to buy.

The last two points in this summary mean that 1949 will be a critical year. We must forestall a sudden drying up of capital expenditures in that year. We must be able also to absorb a great outpouring of production both of capital and consumer goods.

What will happen to business in 1949, therefore, will depend on how successful we are this year in dealing with such momentous problems as taxation, foreign aid and prices. But 1949 *can* be a good year too.

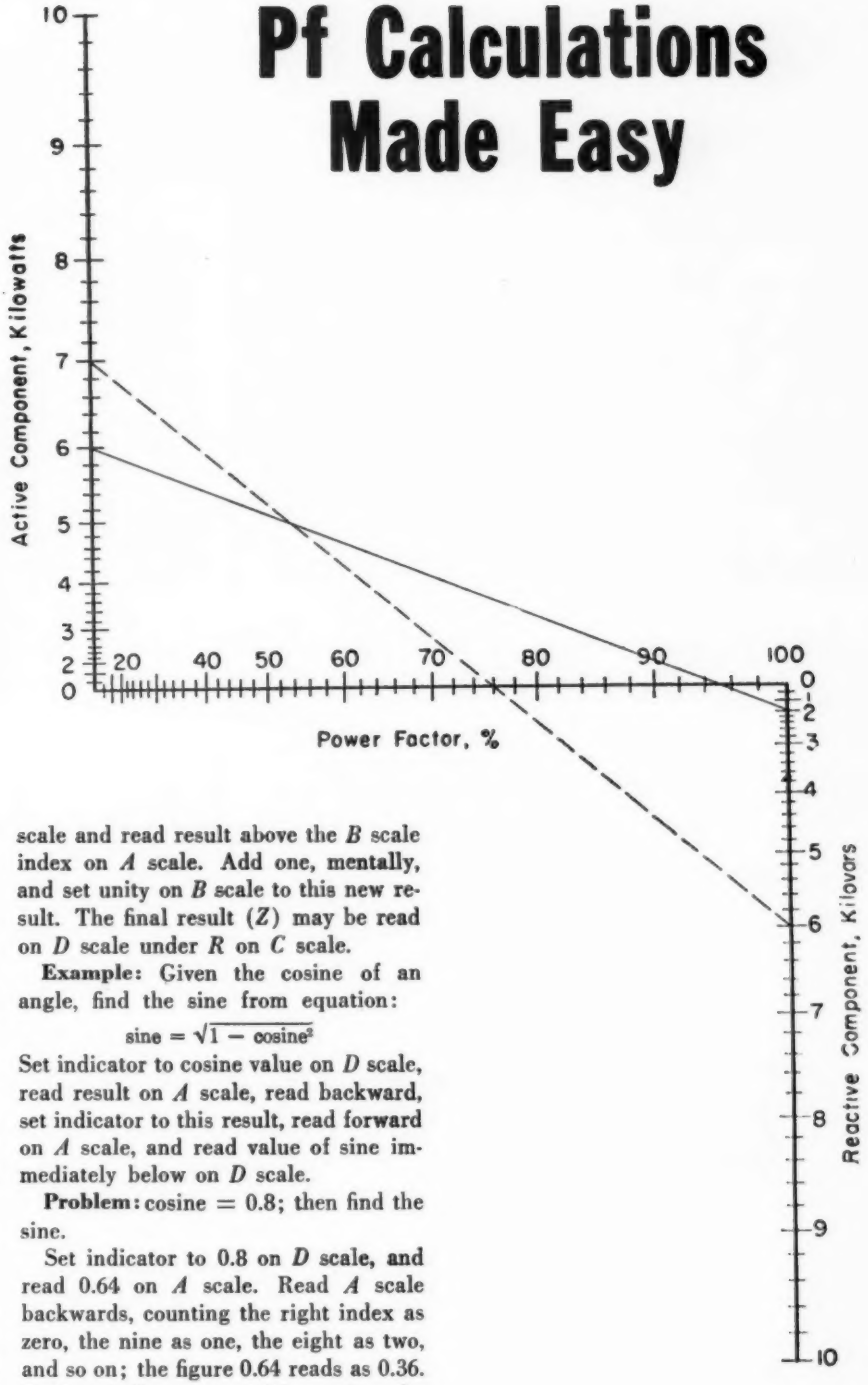
The next editorial in this series will discuss the pivotal problem of taxes.



President, McGraw-Hill Publishing Company, Inc.

Pf Calculations Made Easy

There are many ways to solve power-factor problems. Here's how G Oldroyd, of Birmingham, England, makes simple slide-rule calculations. His handy pf nomogram will fill a useful place in any power plant



▶ THE ARTICLE "Homemade Calculator Gives Power Factor," p 103, October 1946 POWER, makes rather heavy going of a comparatively simple operation. Power-factor values can easily be obtained from kilowatt and kilovar readings, using an ordinary slide rule. The solution is self-contained and does not require trigonometric tables.

On the slide rule, set kilowatts on *C* scale above kilovars on *D* scale, and read the result on *A* scale opposite the index on *B* scale. To this value add one, mentally. Move the index on *B* scale to this new result on *A* scale. Power factor may now be read on *C* scale opposite the index on *D* scale.

Taking the example in the article, set 20,000 kilovars on *D* scale against 60,000 kilowatts on *C* scale, and read 0.111 on *A* scale, above the right-hand index of *B* scale. Adding one to this result, set the left-hand index of *B* scale to 1.111 on *A* scale, and read 95% on *C* scale above the right-hand index on *D* scale.

Many other vector problems can be solved in a similar manner on a slide rule. The following may be of interest:

Example: Square root of the sum of the squares:

$$Z = \sqrt{X^2 + R^2}$$

Rearrange in the form:

$$Z = R\sqrt{\left(\frac{X}{R}\right)^2 + 1}$$

Set (X) on *D* scale, opposite (R) on *C* scale and read result above the *B* scale index on *A* scale. Add one, mentally, and set unity on *B* scale to this new result. The final result (Z) may be read on *D* scale under *R* on *C* scale.

Example: Given the cosine of an angle, find the sine from equation:

$$\text{sine} = \sqrt{1 - \text{cosine}^2}$$

Set indicator to cosine value on *D* scale, read result on *A* scale, read backward, set indicator to this result, read forward on *A* scale, and read value of sine immediately below on *D* scale.

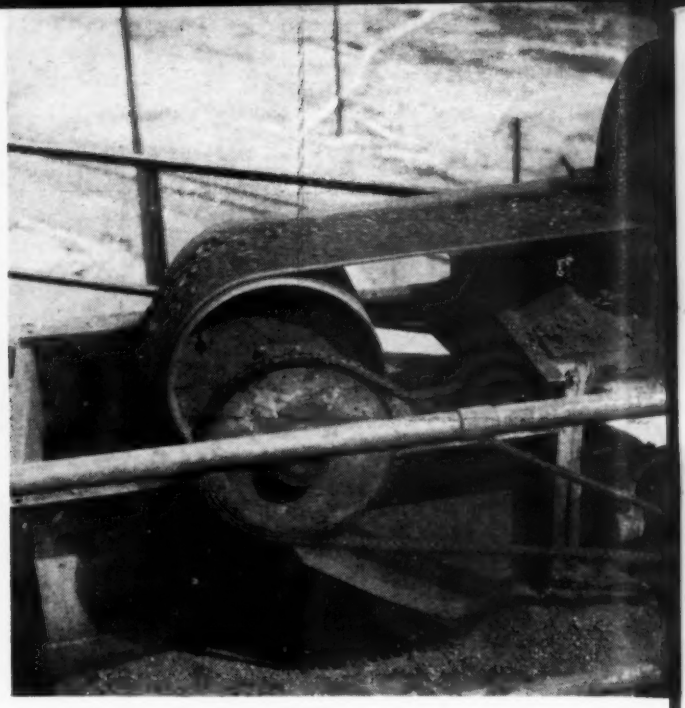
Problem: cosine = 0.8; then find the sine.

Set indicator to 0.8 on *D* scale, and read 0.64 on *A* scale. Read *A* scale backwards, counting the right index as zero, the nine as one, the eight as two, and so on; the figure 0.64 reads as 0.36. Setting indicator to 0.36 on *A* scale, read 0.6 on *D* scale immediately below.

If unskilled personnel have to carry out these calculations the nomogram in the diagram quickly determines power factor from readings of kilowatts and kilovars.

When calibrated over suitable ranges and with a straight edge placed across known values of active and reactive components this nomogram gives the power factor on the horizontal center scale. As long as the ratio kvar/kw remains unaltered, for any particular values of kw and kvar, or mw and mvar scale values, the kw and kvar values can be adjusted by multiplying by the same constant factor. For example, 6 mw on the chart can be multiplied by 10 and read as 60 mw; similarly 2 mvar is read as 20 mvar. The power factor of 0.95 is indicated on the horizontal cosine scale, which, of course, requires no modification. This is the same example as the one in Oct 1946, POWER.

1 Powerful magnetic alloy castings mount on magnetic steel plates, give flat separating surface for hoppers, chutes



2 Pulley and drum assembly, above, to remove tramp iron from belt-conveyed material, gives fully automatic service

Let Magnetic Separators Remove

Even though it is cleaned at the mine, coal can pick up, en-route, odds and ends of metals that may 'throw a wrench' into a coal-preparation plant. You can lick such a problem with one of these major types of permanent-magnetic separators

By R F MERWIN, *Vice-President and General Manager*
Eriez Manufacturing Company

► PERMANENT MAGNETIC SEPARATORS possess many advantages that can be put to use in the power field for removing unwanted tramp iron, brought into your plant with the coal supply. They can be put to work in hot, cold or wet surroundings, and give uninterrupted cleaning service.

Just what can you expect from such a piece of equipment? It serves a 2-fold purpose: (1) It functions as preventive maintenance for screens, crushers, hammermills, pulverizers and nozzles by saving them from the wear and damage that tramp iron imposes. (2) It is a safety provision in hazardous coal-dust locations. Foreign metal, traveling in steel chutes or conveyor systems, has been known to release a spark upon striking other metal or concrete. Sparking develops more readily within coal crushers, hammermills or grinders. In any case a spark can set off an explosion.

But to be effective magnetic separators should be selected and installed correctly, and be used under the right operating conditions. For instance, choose a point along the incoming coal supply line where (1) depth of coal is within the effectiveness of the equipment design (2) travel is at a low enough rate for the influence of the magnetic field to be felt.

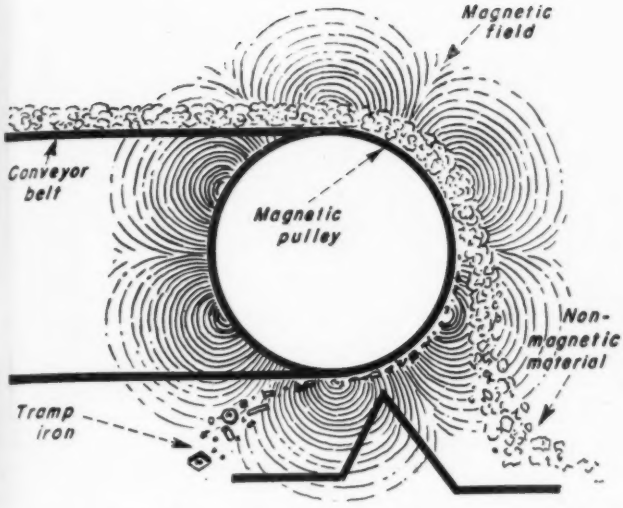
What's available? Three basic types of permanent magnetic-separating equipment are commonly used in coal and coke processing and conveying lines: (1) plate type (2) pulleys and drums (3) magnetic humps.

Plate Type. The plate unit, Fig. 1, is a flat unit, as its name implies, made up of a series of powerful, stable, magnetic alloy castings. These castings mount on magnetic steel plates, surrounded by an insulation strip of non-magnetic material. This strip provides a lip to prevent leakage of material or magnetism when the unit is part of a metal chute or cast-iron hopper bottom.

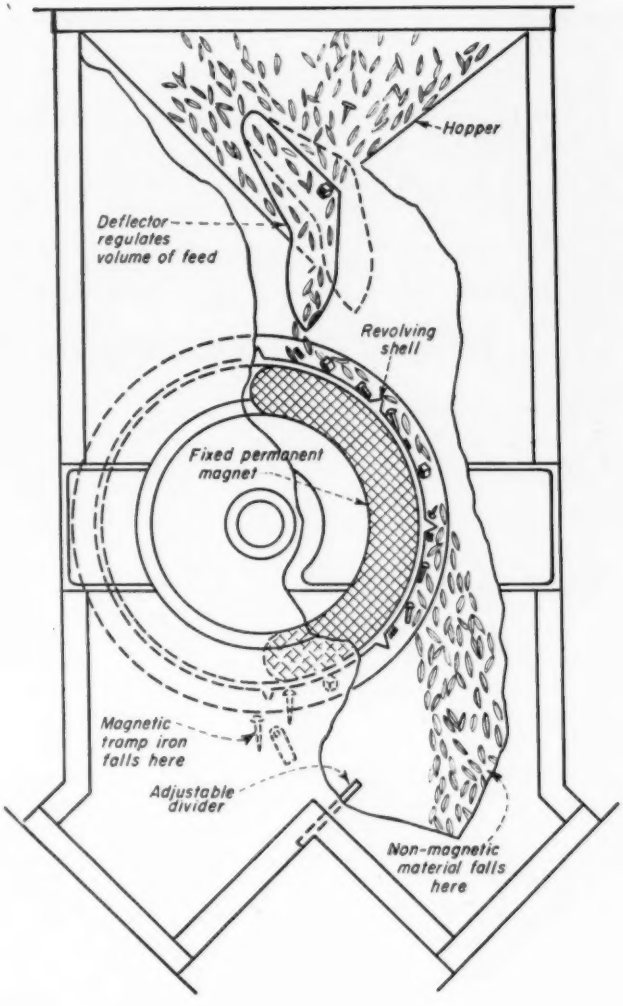
Because of its flexible design the flat type is easily installed in existing as well as new equipment. The separator face can be made part of the bottom of a gravity-flow chute or hopper. With this arrangement all ferrous material in the coal is pulled to the magnet and held there while the clean coal flows on.

Because initial cost is low, plates often serve as follow-ups for overloaded magnetic pulleys that may pass iron.

There are limitations to their use. Plate-type magnets are not 100% effective where (1) depth of coal exceeds 5 in. (2) chute or hopper pitch exceeds 60 deg. In recent months plate-type magnets of extremely high magnetic-field strength have been built for heavy-application service. They are built of abrasive-resistant steel and have a stepped face, behind which accumulated metal lodges.



3 Magnetic field attracts and holds tramp iron to the belt as it passes the pulley. Nonmagnetic material falls free



4 (right) Material enters at drum top, is pulled to the sides of revolving shell; magnet holds iron beyond divider

Tramp Iron

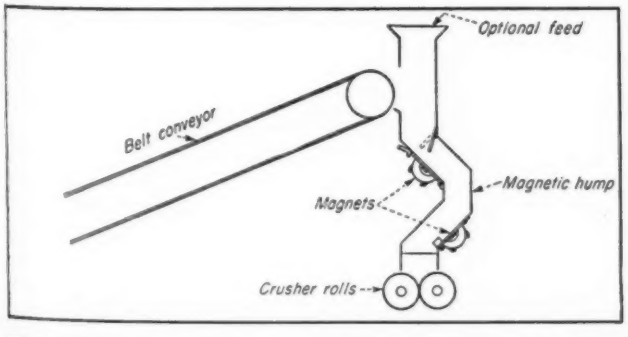
Most plates are rectangular in shape. The long measurement extends the full width of a gravity-flow hopper or chute. Trapezoidal-shaped units are usually produced to fit an existing setup.

Once tramp iron collects on plate-type magnets its removal is carried out by hand. A magnetic hoe or similar device pushed along the air gap to the edge of the magnet carries all accumulated material with it. Once at the edge of the magnet the material can be dislodged and thrown into a container.

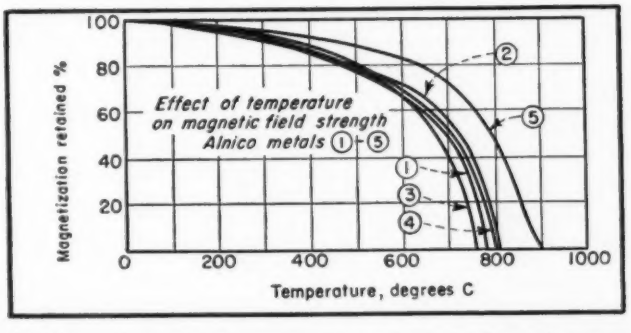
Pulleys and Drums. This class of magnetic separator removes tramp iron from belt-conveyed nonmagnetic material if depth of material, belt speed and thickness are not excessive.

As the belt-conveyed material reaches the pulley, Fig. 2 and 3, the magnetic field attracts and holds tramp iron to the belt as it passes over the pulley. Nonmagnetic material falls freely. The magnetic pieces stick until the belt carries them beyond a divider where the iron drops. A chute is usually provided to catch and remove the dislodged iron.

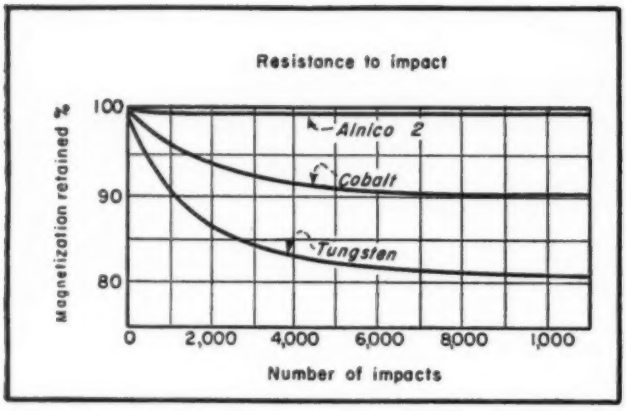
Removal of tramp iron by this method is fully automatic. Its effectiveness depends on the three factors mentioned above (1) depth of coal (2) speed of conveyor (3) thickness of belt. For most efficient results top operating speed for the pulley is 40 rpm. Usually, however, it is much less. Generally speaking the lower the rpm, the greater the depth of material that can be



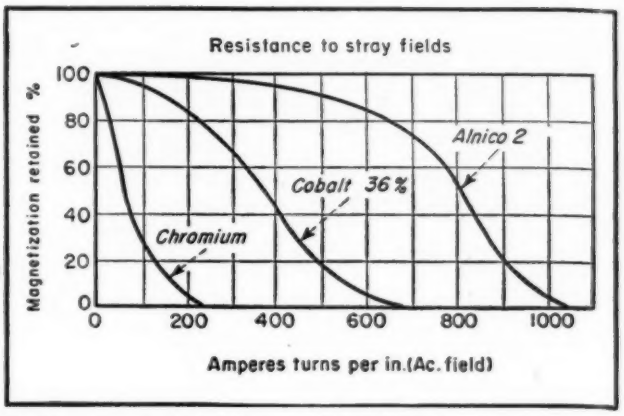
5 Magnetic hump—a pair of plate-type magnets in sheet metal or cast-iron housing—cleans iron in heavy volumes



6 Magnetic field of permanent magnet used in this type separator holds strength against temperature rise, above



7 Impact or vibration of magnet under normal operating conditions affects magnetic fields above, but only slightly



8 Stray magnetic fields can affect the field of a permanent magnet. Above curve shows the effect of various fields

cleaned for a given belt thickness. A word of caution: Since the belt thickness separates material from the face of the magnet, provide a manufacturer with dimension specifications.

Pulleys of 24 in. dia have been known to clean successfully crushed coal up to 4- to 6-in. depth on a belt conveyor. Pulleys up to 30 and 36 in. dia are now being produced for heavier service, for instance, run-of-mine coal.

Magnetic Drums. Another form of self-cleaning magnetic separator is the magnetic drum, Fig. 4. Material introduced to the top of the drum comes under the influence of the magnetic field. It is pulled to the sides of a nonmagnetic revolving shell. The shell carries both nonmagnetic and magnetic material through the stationary magnetic field. Nonmagnetic material falls off after it passes a divider plate; magnetic carries beyond, Fig. 4.

Drums are compact, can double as a means of even feeding of free-flowing material and give automatic removal of tramp iron. Their application is usually with materials that cannot be cleaned by pulleys.

Magnetic Humps. Two plate-type separators, enclosed in a rectangular sheet metal or cast iron housing, Fig. 5, constitute a magnetic hump. Such a device, in sizes from 4- to 40-in. width, removes tramp iron from heavy volumes of material.

When located in vertical or steep drops these separators constitute a barrier in the material path. This barrier sets up a tumbling action that gives the magnetic field a chance to clean tramp iron from the material. They have also been tried successfully in pneumatic conveying systems.

The Magnet. Now how about the heart of magnetic separators—the magnet? It is made of a magnetic alloy consisting of aluminum, nickle cobalt and iron. This alloy once charged by a strong electromagnetic field possesses interesting characteristics.

Unless acted upon by a demagnetizing force in excess of that provided for in the initial stabilizing treatment, the alloy retains its magnetism. This same material in domestic watt-hour meters gives a constant magnetic field within a few one-hundredths of one percent per century. It stays that way unless (1) exposed to heat over 300 C, Fig. 6 (2) subjected to impact or vibration, Fig. 7 (3) influenced by stray magnetic field, Fig. 8 (4) changed in physical arrangement such as increasing air-gap length.

Even if a magnet reaches 300 C it retains 90 to 95% of its peak power. Upon cooling it returns to 98 to 99% of its original magnetic strength.

As for vibration, the Mill Mutual Fire Prevention Bureau in Chicago put a magnetic separator on a heavy hammermill subjected to severe vibration. After a year it retested at slightly less than its original magnetic strength.

A stray magnetic field, too weak to pull a paper clip loosely held on the end of a pencil, will not affect a permanent magnet of this alloy construction in any measurable way.

Freezing Hits a New Low

► LIQUEFIED HELIUM develops temperatures as low as —456 F and does it on a large enough scale for research work. A device now regularly produced, the Collins helium cryostat, is credited with such a performance. Last November, Allen Latham, Jr and Dr H O McMahon, of Arthur D Little, Inc, presented the subject in a paper before the American Institute of Chemical Engineers.

Cold space of the unit and part of the refrigerating equipment is contained within a steel vacuum jacket. Other accessories include a 10-hp compressor and a gas holder for the helium. Novel technical features include: (1) heat exchanger that cools the compressed helium from room to liquid-helium temperature (2) piston-expansion engine developed for oxygen generation.

The expansion engines use flexible coupling rods in tension. This aligns a specially hardened, close-fitting piston within the cylinder. The arrangement permits piston operation at the extremely low temperatures without lubrication.

Helium is kept pure. No cleanup system, requiring a continuous supply of liquid air to freeze out impurities, is needed, and laboratory technicians handle the machine without attention by scientific personnel.

Seven of these machines are now in operation—in university, government and industrial laboratories. Until 1947 when the cryostat appeared only four helium liquefying installations existed in North America. All were specially designed for a specific laboratory. They employed a cascade refrigeration system to reach desired temperatures.

VERTICAL TURBINE PUMPS Q&A

W C Mumford, application engineer, vertical turbine-pump division, Worthington, gives practical information on construction, operation, characteristics, troubles, remedies

3—Installation: Troubles and Remedies

Q 1—What precautions should be taken during installation of a pump to avoid operating troubles?

A—Unlike most centrifugal pumps, a vertical turbine pump generally requires field assembly of the various parts. These have been carefully manufactured to close tolerances, and are part of a machine, not merely a "string of pipe." Observance of the following 13 points helps prevent troubles that might result from faulty installation.

1. Thoroughly inspect shipment to be sure no damage occurred in transit.
2. Locate installation equipment hook accurately over the well's center line.
3. Check shaft in bowl assembly to be certain it rotates freely without binding or misalignment.
4. Be sure pressure relief vent, in the diagram, is open in bowl-assembly discharge casing of oil-lubricated pumps.
5. Remove burrs on ends of shafting or oil tube. A 0.005-in. burr on the end of a shaft causes considerable misalignment and rapid bearing wear.
6. Handle shafting carefully so there is no possibility of bending.
7. Before assembly, thoroughly clean all threads and finished surfaces.
8. Make up all joints to proper location so shaft end or enclosing tube is properly located in relation to column pipe throughout pump length. Failure to tighten column pipe to seats causes errors in shaft or enclosing-tube extension when the driving head is assembled. Correct assembly of column pipe also insures proper location of bearings and sleeves in open-shaft pumps.
9. Set driving head so its axis is in alignment with the pump's center line. The driving head's center line may not always be perpendicular to the ground level as would happen in a slanting well. Before grouting, shim the driving head.
10. Check rotation of driver before coupling to pumpshaft.
11. Adjust impeller vertical clearance in accordance with manufacturer's instructions. Accurate adjustment is required for best performance of semi-open impeller.
12. Lubricate both pump and driver according to instructions.
13. Do not let discharge piping put unnecessary strains on the pump.

Q 2—What maintenance do vertical-shaft turbine pumps require?

A—Wells may require cleaning, bailing, development, renewal of casing, straightening, or other services of a well driller or engineer. Sumps, pits and tanks require periodic cleaning and checking so suction conditions remain correct. Maintain the discharge system to meet head and capacity characteristics. Carefully study proposed changes in the system for effect on pump operation. Float controls, pressure controls, alternators and other similar devices must be kept properly adjusted and regulated.

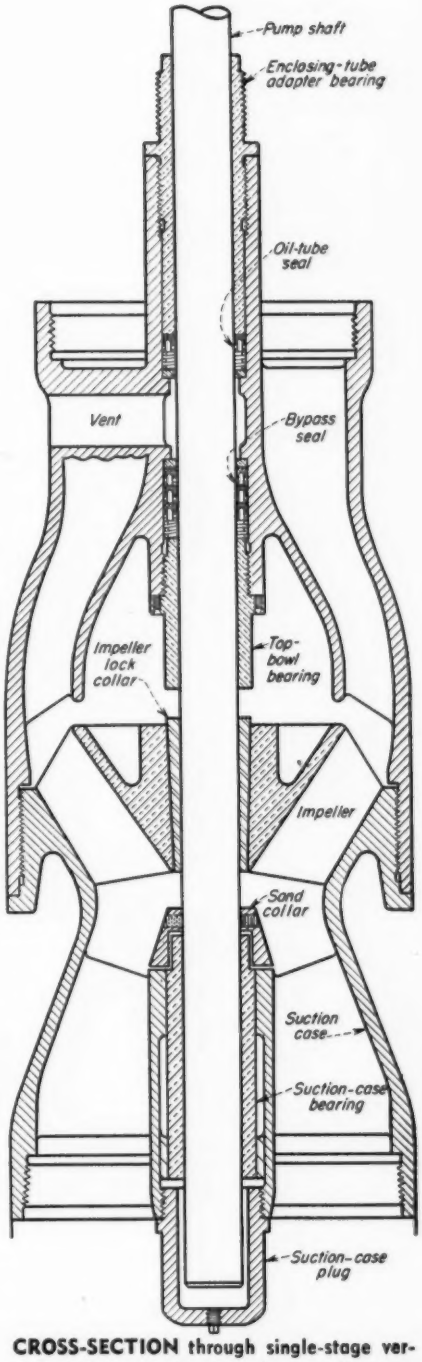
Very little mechanical maintenance is required. Follow religiously the operating and maintenance instructions that are furnished with pumps and drivers.

Keep the oil reservoir full on oil-lubricated pumps and maintain correct flow to the bearings. Most pumps require only four to six drops of oil per minute of 100- to 150-ssu viscosity at pumping temperature. Water-lubricated pumps require occasional packing adjustment or replacement. Where rubber-line-shaft bearings are prelubricated, the prelubrication equipment must be kept in proper operation.

Q 3—What are the principal causes of vertical - turbine - pump troubles?

A—Misapplication, unsuitable well conditions, faulty installation, poor maintenance and mechanical defects are the basic causes.

(*Continued on page* 104)



CROSS-SECTION through single-stage vertical-shaft centrifugal turbine well pump

CHECK CHART FOR VERTICAL TURBINE PUMPS:

I: PUMP WON'T START

A—Faulty wiring or motor:

1. Check current characteristics with data on motor nameplate.
2. Check wiring with diagram and data on motor nameplate.
3. Be sure starter is properly connected and correct for horsepower and voltage.
4. Check fuses or circuit breaker for open power line.
5. Reset starter overload relays if tripped.
6. Check remote control stations for possible open circuit.
7. If motor fails to operate independently of pump with all wiring correct, call motor manufacturer's engineers.

B—Excessive bearing friction:

1. Use oil of 100-150 ssu at pumping temperature on enclosed shaft of oil-lubricated pumps. Lubricate all bearings before operation.
2. On oil-lubricated pumps, lack of proper tension on the shaft-enclosing tube may allow misalignment through bearings. Be sure tube tension nut is tight.
3. Be sure enclosing-tube stabilizers are properly located in column assembly.
4. Rubber bearings in water-lubricated units may seize if dry. Lubricate before starting.
5. Bent shafts must be replaced.
6. Crooked wells causing misalignment must be straightened or a pump of small enough diameter installed to hang freely in the well.
7. Check for misalignment caused by crossed threads, burred or dirty dowel fits or finished surfaces. Align head center line with pump center line. Improper anchoring of head can cause distortion and bending of pump.

C—Incorrect impeller adjustment:

1. Set impellers high enough to allow for shaft stretch due to hydraulic thrust. When adjustment allows shaft to turn freely, stretch caused by shaft and rotor weight have been taken care of. Additional clearance may be necessary to allow for shaft stretch during pumping caused by hydraulic thrust. Charts are available to calculate compensating adjustment required. If adjustment is too high, impellers may rub.

D—Impellers are locked:

1. Sand locking is common. Sometimes raising and lowering impellers by the adjusting nut frees them. Backwashing with clear water may help. Careful use of a stillson wrench on the shaft top may free the impellers. When these methods fail, pull the pump and dismantle the bowl assembly to free the impellers.
2. Corrosion, graphitization or bacterial growth may lock the rotating element. This is especially true where the pump is idle for long periods in brackish or acid water. Barnacle accumulations under similar condition in sea-water pumps have the same effect.
3. It is usually necessary to disassemble the pump and remove the encrustations by submersion in an acid bath. Commercial preparations are available, but extreme care must be taken and pump manufacturer's recommendations followed.
4. Proper selection of construction materials helps prevent this trouble.
5. Obstructions, such as pieces of wood, rags or metal, may prevent rotation. Disassemble and remove as required. A suction strainer helps guard against this.

E—Packing is too tight:

1. Normally, packing should be adjusted to allow a slight leakage for cooling and lubrication.

F—Other causes:

1. Pump is frozen.
2. Well has collapsed.
3. Earthquake or other force may cause serious misalignment.

II: PUMP WILL NOT DELIVER WATER

A—Pump is not primed:

1. Vertical turbine pumps will not start pumping against a suction lift. Be sure lowest impeller is submerged.
2. On a closed suction pump, be sure suction head meets requirements of the unit.
3. Vent wells to atmospheric pressure so pump does not operate under a vacuum at its suction.

B—Rotation is incorrect:

1. Correct rotation of the driver. Three-phase motor rotation can be changed by transposing any two of the power leads at the motor's terminals or at the switch.

C—Pumping head is too high:

1. Lowered pumping level (higher lift) or increased pressure on system beyond the pump's discharge can cause a total pumping head higher than that the pump develops.
2. Increased discharge pipe size or reduction in discharge pressure may be necessary. If this is not possible, install a pump that meets existing conditions.
3. Be sure discharge valves are open and check valves free.

D—Overpumping well:

1. Drawdown, that is, the difference between the static and pumping levels in a well, may lower the pumping level enough so the pump breaks suction. This condition can cause serious harm to both pump and well. Throttle the discharge or use other means to reduce pump capacity and prevent overpumping.

E—Pump speed is too low, resulting in insufficient head:

1. Be sure frequency and voltage are correct for motor-driven units.
2. Be sure gear ratio and output speed of prime mover are correct for gear-driven units.
3. Check pulley size and prime-mover speed on belt-driven units.
4. Be sure pump turns freely and mechanical troubles are not retarding speed.

F—Suction is clogged:

1. Make sure strainer, suction pipe and impellers are not clogged. Backwashing may clear.
2. Well screens may be clogged and require the services of a competent well man.

G—Mechanical failure:

1. Check for broken shaft and replace.
2. Make sure none of the impellers is loose.
3. All column pipe joints must be tight to eliminate excessive leakage.
4. Check bowl assembly and make sure it is not broken.

III: CAPACITY TOO LOW

A—Head is too high:

1. Centrifugal pump performance is such that an increase in head results in a decrease in capacity. Conversely, decreased head increases capacity (see II C).

Q 4—What troubles can be attributed to faulty application?

A—Both hydraulic and mechanical troubles can result from improper pump selection. But poor application can nearly always be traced back to the manufacturer's engineers making pump selection and recommendations from a purchaser's data that were incorrect or insufficient.

Incorrect capacity information can result in selection of a pump that may overpump the well. Cavitation and vibration can follow with rapid deterioration of wearing and hydraulic parts.

Selection of construction materials can be in error because of lack of information concerning the liquid to be pumped. Sea water, for example, requires accurate information for correct material selection. It is not unusual for standard construction to give excellent service in one location, whereas special materials are required a short distance away because of difference in water analysis.

Suction conditions, including water level when pumping, temperature, viscosity, specific gravity, degree of aeration and other factors often determine location of the suction inlet. Adequate submergence is important because low submergence may cause cavitation, low capacity, high power input, vibration or other troubles.

For data on proper vertical-turbine-pump application see Feb POWER. p 105.

Q 5—What are some of the bad effects that develop from installing a pump in a crooked well?

A—A crooked well can cause a bent pumpshaft, vibration, excessive wear, high power input and similar troubles because of misalignment. It is usually impossible to install the maximum size pump designed for a given casing in a crooked well. Never force a pump

CAUSES OF TROUBLE AND SUGGESTED REMEDIES

B—Speed is too low:

1. See II E, which is listed above.

C—Poor suction conditions:

1. Pit or sump must be properly designed so liquid velocities and suction submergence are in accordance with manufacturer's recommendations. Do not allow turbulence, eddying and vortexing at the pump's suction. Baffling or other modifications may be all that is necessary.
2. Aerated or gaseous water has the effect of reduced capacity.
3. Check suction piping for air leaks.
4. Properly vent the well.
5. Be sure suction head on closed-suction pumps is correct.
6. Check for obstructions in strainer, suction pipe and bowls.
7. Check for partial clogging of water passages because of corrosion, bacterial growth or other causes.

D—Leakage:

1. Tighten all pipe threads and flanges.
2. Replace worn gaskets or packing.
3. Be sure there are no cracks or holes in column pipe, bowl assembly or discharge head.

E—Incorrect impeller adjustment:

1. Operating clearances of semi-open impellers must be close. To obtain maximum capacity, be sure impellers are adjusted as close as possible to the bottom of their casing; otherwise, excessive leakage reduces pump capacity.

F—Mechanical failures:

1. Worn impellers or wearing rings allow leakage, which reduces capacity. A slight increase in capacity can sometimes be obtained by resetting the impeller adjustment for operation closer to the bowls, but if parts are badly worn, replacement is necessary.
2. On enclosed-shaft pumps, worn bearings below the relief vent in the discharge casing may allow excessive leakage through the vent (drawing p 103) and cause reduced discharge capacity.
3. Impellers loose on pump shaft.

G—Defective test equipment:

1. Make sure water level when pumping is accurately determined.
2. Calibrate pressure gage.
3. Check accuracy of capacity-measuring devices.

IV: TOO MUCH POWER

A—Operating conditions different from those for which pump is designed:

1. Check pump curves. If conditions cannot be corrected to satisfy pump's horsepower requirements, a larger motor may be needed.
2. Speed of gear- or belt-driven pumps can often be reduced to lower the horsepower. This also reduces pump capacity and head.
3. Diameter of most impellers can be cut down to reduce horsepower, which also reduces capacity and head.
4. Where there is a wide difference between actual operating and pump design conditions, it may be necessary to change the pump.

B—Rotation is incorrect:

1. See II B, as given above.

C—Speed too high, resulting in overcapacity and higher head:

1. See section II E, 1, 2 and 3.

D—Liquid different from that for which pump is designed:

1. Higher specific gravity may require a larger motor.
2. Higher viscosities can sometimes be corrected by heating the liquid.
3. Air or gas in water can cause cavitation. Increased submergence, lower inlet velocity, or other suction changes may help correct trouble.
4. Sand in water may indicate that suction area needs cleaning out. Wells may require new screens or sand pumping to develop water bearing strata.

E—Impellers rub because of incorrect adjustment:

1. See section I C, listed above.

F—Lubrication is incorrect:

1. Check for proper quantity and viscosity of oil in oil-lubricated pumps.
2. Be sure liquid is lubricating all bearings in open-shaft pumps. Where several bearings may be located between foundation level and underground elbow, it may be necessary to install an air-release valve in the column to allow water to reach all bearings.
3. Be sure driver bearings are lubricated according to manufacturer's instructions.

G—Packing too tight:

1. See section I E, as listed above.

H—Mechanical failure:

1. Check for misalignment (see I B).
2. Make sure bearings are not too tight.
3. Correct cause of any vibration.

V: PUMP VIBRATES

A—Misalignment:

1. See section I B, as given above.

B—Bearing failure:

1. Be sure lubrication is correct.
2. Check for excessive sand in water.
3. Correct pump alignment.

C—Poor suction conditions:

1. Correct possible cavitation (see III C—1, 3, 4 and 5).

D—Unbalance:

1. Operate driver alone to see if it vibrates.
2. Check for foreign material lodged in impeller or bowl passages. Such material might cause both static and hydraulic unbalance.
3. Check rotating parts for excessive wear. Excessive abrasive in water can change water passages and cause hydraulic unbalance. Wear also changes static unbalance.

VI: WATER IN THE SHAFT-ENCLOSING TUBE

A—Enclosing-tube failure:

1. Replace broken or leaking sections.
2. Renew broken or loose bearings.
3. Be sure all joints are tight.

B—Failure in bowls:

1. Make sure discharge case vent is not plugged.
2. Be sure bearing below vent is not worn or scored, allowing excessive pressure on vent.
3. Check pumpshaft for wear that would produce excessive bearing clearance.
4. Be sure bearing above vent is not worn or scored, allowing any excess leakage to go into enclosing tube instead of through vent.

Note: Question 18 in Jan *Power*, p 146, explains the function of the discharge-casing vent and adjacent bearings.

---

into a well; it should hang free when installed.

Q 6—What factors should be kept in mind when selecting a pump to install in a well with a perforated casing?

A—In some areas, wells are constructed with perforated casings. During drilling operations, minor water-bearing formations may be discovered above the main source of water supply. To obtain maximum capacity from the well, the casing section in the upper water-producing sands is installed with drilled holes, or more often, torch-cut slots or perforations that allow supplemental water to enter the well. Burrs or welding slag, which build up inside the pipe when the perforations are cut, often have the effect of reducing the casing's inside diameter so a 12-in. pump having a 11½-in. outside diameter cannot be installed in a 12-in. casing.

Even though perforations are carefully made, a pump to be installed in a well of this type should be at least one size smaller than the casing inside diameter if the bowl assembly is to be located below the perforated section. This is because the perforations permit sand, gravel and other material from the water-bearing formation to be carried into the well. A 12-in. pump is usually 11½ in. outside diameter, which in a 12-in. casing allows ¼-in. clearance around the bowl assembly. This relatively small area limits the flow to the pump inlet from above the bowls.

Of more importance, this small clearance prohibits passage of larger particles carried through the perforations in the casing. These particles build up around the bowl assembly and may seal off water flow from the upper source and prevent venting the main supply to

(Continued on page **138)**

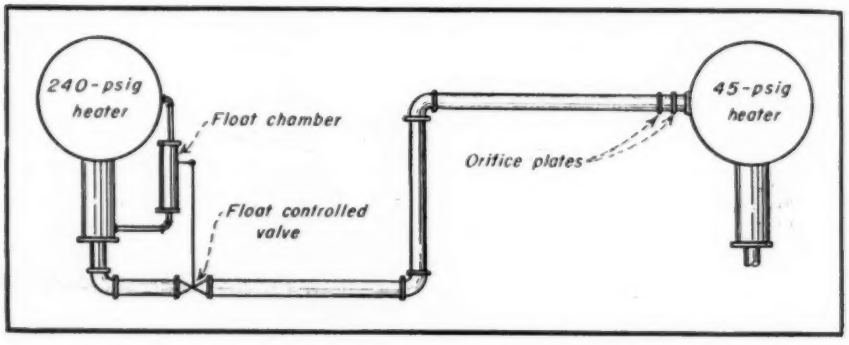
POWER ENGINEERS' NOTEBOOK

PLANT-TESTED IDEAS TO SOLVE PROBLEMS OF DESIGN, OPERATION AND MAINTENANCE

SERIES ORIFICES REDUCE PIPE EROSION

WE EXPERIENCED considerable trouble from rapid erosion internally of the h-p bleed condensate line discharging into the shell of the l-p heater. This erosion was caused by the high-velocity flow resulting from part of the hot liquid flashing into steam after the pressure was reduced to that of the l-p heater.

To eliminate this condition the obvious solution was to keep the bleed-line pressure as close to that of the h-p heater as possible. This was done by welding up a small section of pipe to contain two orifice plates and installing it in the condensate line near the l-p heater inlet as shown in the diagram. The orifice diameters are proportioned so that at maximum load on the heater the condensate-line pressure is only slightly lower than the h-p heater shell pressure. This eliminates flashing in the condensate-discharge line.



As condensate flow decreases with heater load, flashing occurs in steps between the orifices and maintains a higher pressure in the condensate line, minimizing the flashing and resulting erosion. The series orifices act on the same principle as a labyrinth packing around a shaft.

ORVILLE HOKSCH *Albert Lea, Minn.*

FLUORESCENT DYE DETECTS SMALL LEAKS QUICKLY

WHEN TESTING surface condensers for leakage by filling the steam space with water, the large leaks from ruptured tubes are easily found. But the small leaks through tube cracks and improper tube seating are difficult to see because of the large amount of water flowing down the tube sheet. Though the tube sheet can be almost completely dried with compressed air it has the disadvantage of requiring a great deal of time.

A tube with a small leak soon ruptures if it is not plugged or repaired. To reduce forced outages from this cause it becomes imperative to locate all leaks at one inspection.

Use of a dye, Calco Uranine, and a small portable 14-watt 110-v ultraviolet lamp makes it easy to detect leakage of the smallest amount. One pound of dye added to 20,000 gal of water is a satisfactory working mixture. Easiest way to add the dye is to pour the powdered mixture into the inflowing water stream where it discharges into the condenser steam space. Where the water inlet is inaccessible (1) half-fill the condenser with water (2) pour the powdered dye over the top of the condenser tubes (3) wash it into the condenser by hosing (4) complete the filling by bringing water surface to one inch over the top tubes.

Large leaks, of course, are evident from the volume of water flowing from the damaged tubes. After they have been repaired or stopped the small leaks can be searched for by playing the ultraviolet light over the tube-sheet surface. Small leaks are easily seen because the dye fluoresces with a bright yellow color under violet-ray action.

Where several tubes in the same area are leaking, the dye runs over the tube sheet. A small air hose will blow off the dyed water and individual leaks can be located quickly. Using the air hose in conjunction with the lamp expedites inspection so that two or three square feet can be examined at a time.

The man using the light should be cautioned against looking directly into it for any length of time, as it may injure the optic nerves.

The dye has no effect on sight glasses or equipment, so no special precaution need be taken. Any appreciable water flow soon washes away all traces of the dye, so subsequent tests can be made within a short time with the same equipment if they are needed.

These tools have also been used for the following purposes: (1) detecting blow holes in strainer casings of boiler feed pumps (2) finding extremely small leaks in generators of boiler feedwater regulators (3) locating leaks in vertical condenser joints where the water box, tube sheet and shell are bolted together.

This dye and the portable lamp, which have been used for over a year in our own plant, have proved economical both in the purchase price and in their application to our work.

D E HORNBECK *Cabin Creek, W. Va.*

(*Continued on page* 108)

NOW!

EDWARD WELDED BONNET UNIVALVES*

for service up to 2500 lb at 1000 F

For high pressure service, especially when temperatures are high and variable too, Edward forged steel Univalves are the logical choice.

Edward Univalves are now regularly built in both 1500 and 2500 lb. 1000 F series in all sizes from ½ in. through 2 in. 1½ in. and 2 in. suitable for A.S.M.E. Code blow-off service.

LOOK AT THESE ADVANTAGES . . .

1 LEAKPROOF WELDED BONNET Patented seal welded body-bonnet joint, designed for disassembly if ever necessary. No bonnet joint to leak.

2 PERFECT ALIGNMENT
Integral one-piece bonnet with renewable bronze yoke bushing. Special welding fixtures and single set-up machining result in absolute alignment of all working parts.

3 HARD FACED SEAT AND DISK
Continuous ring of Stellite applied directly on valve body forms seat, and disk is alloy steel with a Stellite face.

4 LOW PRESSURE DROP
Inclined stem construction makes flow passages so straight you can see through them, yet retains globe valve tightness. Pressure drop reduced 25 to 50 per cent, and wear-producing turbulence is at a minimum.

5 FOOLPROOF BACKSEAT
Packing isolated to prevent blow-out when repacking under pressure. Backseat and deep cooling chamber protect packing in service.

6 EASY PACKING ADJUSTMENT
Through - bolted, accurately guided gland.

AND THESE PLUS FEATURES, TOO . . .

- ✓ *Maximum piping flexibility*
- ✓ *Excess weight eliminated*
- ✓ *Oversize knobbed handwheels*
- ✓ *Re-enforced EValpak* molded packing*
- ✓ *Centerless ground stainless steel EValloy* stems*
- ✓ *Abrasion resistant EValized* junk rings*

Edward Intex* valves for 1500 lb 1000 F service available in same size range for services where bolted bonnet globe valves are desired.

Write today for new Edward Catalog 12-G6 describing Univalves and Intex Valves.

***Univalves, EValpak, EValloy, EValized and Intex are registered trade marks of Edward Valves, Inc.**

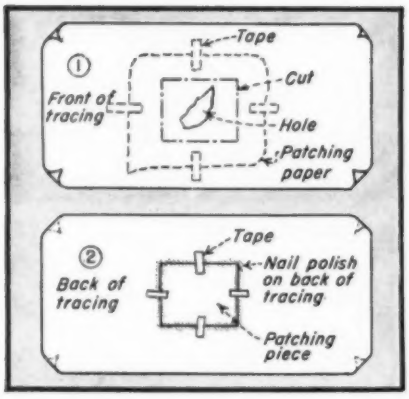
ROCKWELL E V

Edward Valves, Inc.

SUBSIDIARY OF ROCKWELL MANUFACTURING CO. EAST CHICAGO, INDIANA

 (*Continued from page* 106)

HOW TO PATCH TRACING PAPER



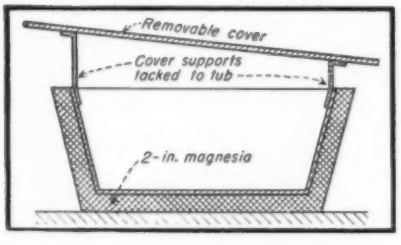
CLEAR NAIL POLISH, the 5 & 10 variety, makes transparent repairs to tracing paper that has been torn or worn through by erasures. The patching edges do not print and the repaired section is stronger than the paper.

Take a new piece of tracing paper, place it over the back of the area to be repaired and tack it in place with pieces of cellulose tape, Fig. 1. With a sharp knife, cut through both patching paper and tracing around the area to be replaced. Carefully peel out the shape cut from the tracing; tack the cut patching piece to the tracing paper with cellulose tape on the front side. Remove tape and excess patching paper from the back. Then apply nail polish to the butt joint of the patching piece and tracing on the back. When the first coat dries within a few minutes, apply a second coat. When polish dries peel away tape.

WILLIAM KAGAN *Brooklyn, N. Y.*

BURN SULPHUR INSTEAD OF USING SULPHURIC ACID

IN TREATING cooling-tower and spray-pond water to reduce calcium and magnesium carbonate, sulphur burning can replace sulphuric acid, which is hard both to handle and to proportion correctly. This practice effects considerable saving in our plant, reducing treatment costs to half. It represents about $200 to $250 monthly reduction.



Sulphur ignites, melts and burns readily making it easy to construct a burner. The burner we started with and used for a number of months was a laundry tub of 30-in. dia. To keep the sulphur molten during cold weather insulate the tub with 2 in. of magnesia as shown in the sketch. An iron cover or hood should be provided to keep out rain and snow.

Burner size can be found by trial and error. Our 30-in. burner consumed 200 lb of sulphur a day. On days of heavy blowdown when this was insufficient we would light off an additional pail or two of sulphur. With the burners set at the cooling tower the latter acted as an absorber for the sulphur fumes. They entered the induced-draft-type tower through the air inlet and were completely absorbed before passing out the top. There was only the slightest "sweetish" smell at the tower's air outlet.

The fog issuing from the tower is slightly heavier during the winter. This has not proved objectionable, however, even for an in-town location.

When the tower water must be chlorinated, stop the sulphur burning for a long enough period in advance for the sulphurous acid to be completely oxidized to sulphuric acid, or the chlorine will be used up. We kept ours off for one hour in advance and an additional hour after chlorination was completed.

K M WHITE *Clinton, Iowa*

Sheet-Metal Housing Protects Outdoor Motor

TO PREVENT the accumulation of dust and grease on a motor driving an outdoor pump, a sheet-metal housing was fitted snugly over the motor. The housing has gaps to span the power connection and to leave the bearing ends exposed for inspection. The skirt or housing base aligns with the motor base, but leaves air gaps around ends and across the feet of the main casting.

Air entering the bottom flows up around the motor and out through the slot at the top. A curved cover set about 1½ in. above the slot allows air circulation but excludes rain and windblown trash. Welded up from light sheet metal the cover can be placed or removed by one man and needs only an occasional coat of paint.

M H PEARCE *Carthage, Texas*

CONTRIBUTIONS INVITED

Do you have ideas and techniques that have been successfully used in practice? Then why not pass them along for everybody's benefit by submitting them for publication in this department? Power pays $20 for each item accepted.

Your manuscript need only be in rough draft form, containing all the facts, and your sketches in pencil. We will take care of dressing them up.

Power Engineers' Notebook will be devoted to power problems, big and little, dealing with design, operation and maintenance. They will range over the entire field—mechanical, electrical, hydraulic, structural, operating procedures, maintenance reduction, testing, etc.

The popularity of the Yarway Liquid Level Indicator as a dependable boiler room instrument for instant, accurate, eye-level readings of overhead water levels, has led to a demand for supplementary *remote* signal devices *operated from the indicator.*

The new Yarway Control Unit with its remote light or horn Hi-Lo Alarm Signals, now answers that demand.

These signals installed at one or more remote points where a check in water level is desirable, provide both high level and low level alarms, within the full operating range of the Yarway indicator.

Light alarms show red for high or low levels—green for normal level. Horn signal has two vibrating horns of different tones, or a single horn for both high and low levels.

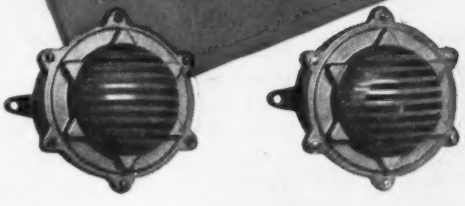
For complete details on this latest addition to the Yarway line of dependable steam plant equipment, write for Bulletin WG-1822.

YARNALL-WARING COMPANY
100 Mermaid Avenue, Phila. 18, Pa.

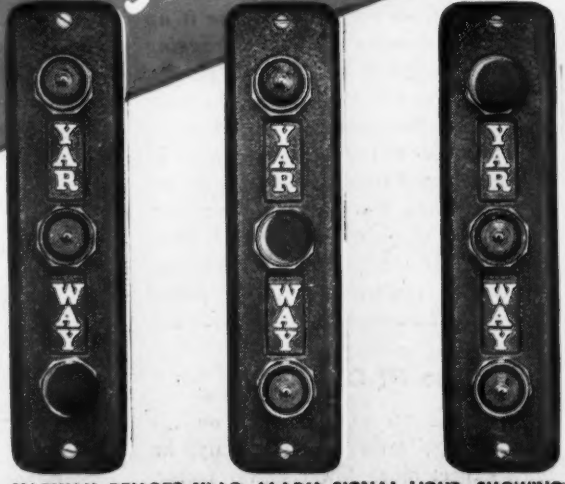
NEW!

WITH YARWAY REMOTE BOILER WATER LEVEL INDICATORS . . .

AUDIBLE AND VISIBLE REMOTE SIGNAL ALARMS



YARWAY REMOTE HI-LO ALARM SIGNAL HORNS.



YARWAY REMOTE HI-LO ALARM SIGNAL LIGHT, SHOWING LOW LEVEL, NORMAL OPERATION AND HIGH LEVEL.

YARWAY REMOTE LIQUID LEVEL INDICATOR

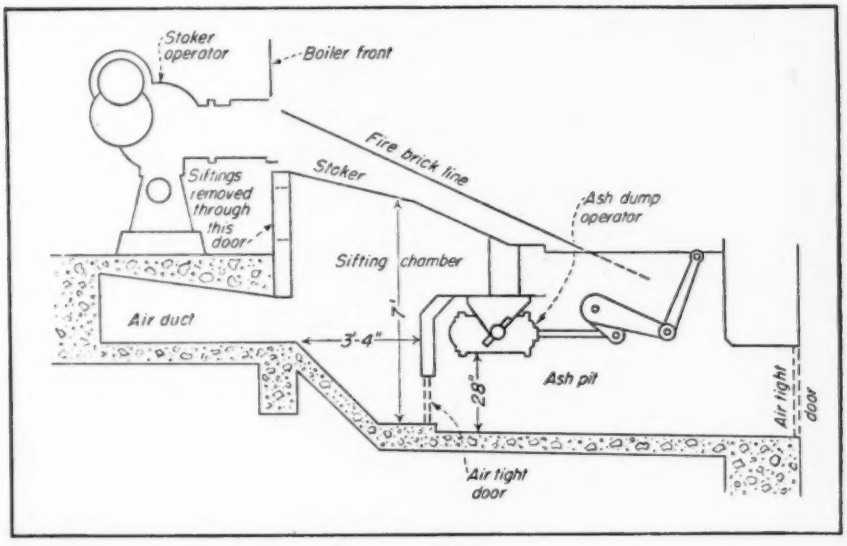
PROBLEMS FROM THE PLANT

Exercise your engineering wits by submitting answers to this question, fresh from the plant. Suitable material will be paid for; answers accompanied by sketches or photographs command additional pay

What Is Best Way to Remove Ash Siftings?

WE HAVE TWO WATERTUBE BOILERS, each fired with an underfeed stoker as shown in the sketch at right. The compartment under the front of the stoker is a siftings chamber, which collects the fine ash that drops down. This compartment fills with ash siftings that must be removed on an average once a month. The chamber is not readily accessible, so any siftings that collect have to be shoveled through the airtight door in the front, as indicated on the sketch. We find this job both disagreeable and tedious.

We have tried one or two schemes for removing the ash by machine, but to date have found no practical remedy. Have any of POWER's readers encountered a similar condition, and worked out a good solution?—HWW



Readers' Answers

Can I Turn Down a Squirrel-Cage Rotor?

(This question is from Dec issue with best answers from readers.)

IN OUR PLANT *we have a large number of squirrel-cage induction motors from 5 to 100 hp. Speed of these motors ranges from 875 to 3450 rpm, with the majority running 1750 rpm. We do all our own motor repair work. On several occasions we have wanted to take a small cut from the rotor to true it up because of damage caused by dragging when bearings fail, or from other faults.*

I have been told that turning the rotor down will affect motor performance but no one is able to tell me exactly what to expect. Can POWER *readers give me some idea how much, if any, I can machine from a squirrel-cage rotor? Does reducing the rotor diameter affect motor torque, efficiency or power factor and, if so, how much?—HE*

Calculate Pf Change

IF *HE* HAS TO TAKE A CUT on his squirrel-cage rotor to true it up, he must expect much lower power factor, efficiency and increased heating. Length of air gap in induction motors is critical and a small increase results in a rise in magnetizing current.

For example, take a 30-hp 550-v 3-phase 60-cps 900-rpm motor. Design characteristics are: 8 poles; inside diameter of stator, 22 in.; length of rotor, 6 in.; flux per pole, 1,200,000 lines; length of air gap, .03 in.; stator and rotor slots are closed. Assume 96 slots on the stator, with 6 conductors per slot.

Using a well-known formula to calculate the magnetizing current:

$$I_o = \frac{P \times \phi \times L_g}{1.7 \times N \times L_p \times P_p \times L}$$

in which

P = No. of poles
ϕ = flux per pole
L_g = effective air gap
N = No. of phases
L_p = turns per phase
P_p = pole pitch
L = length of iron parallel with haft

Using this formula for our imaginary motor, pole pitch becomes;

$$\frac{3.14 \times 22}{8} = 8.64 \text{ in.}$$

Slots are closed so we can take the actual gap as the effective air gap. If the slots were open, gap length would have to be corrected for fringing. There are 96 slots, or 32 slots per phase. This gives $32 \times 6 = 192$ conductors, or 96 turns per phase. Substituting in the formula:

$$I_o = \frac{8 \times 1{,}200{,}000 \times .03}{1.7 \times 3 \times 96 \times 8.64 \times 6} = 11.4 \text{ amp.}$$

Now if we take a cut on the rotor, say, $\frac{1}{64}$ in., or about .016, the gap will be 0.46 in. Calculating as before, we find that the magnetizing current becomes 17.5 amp.

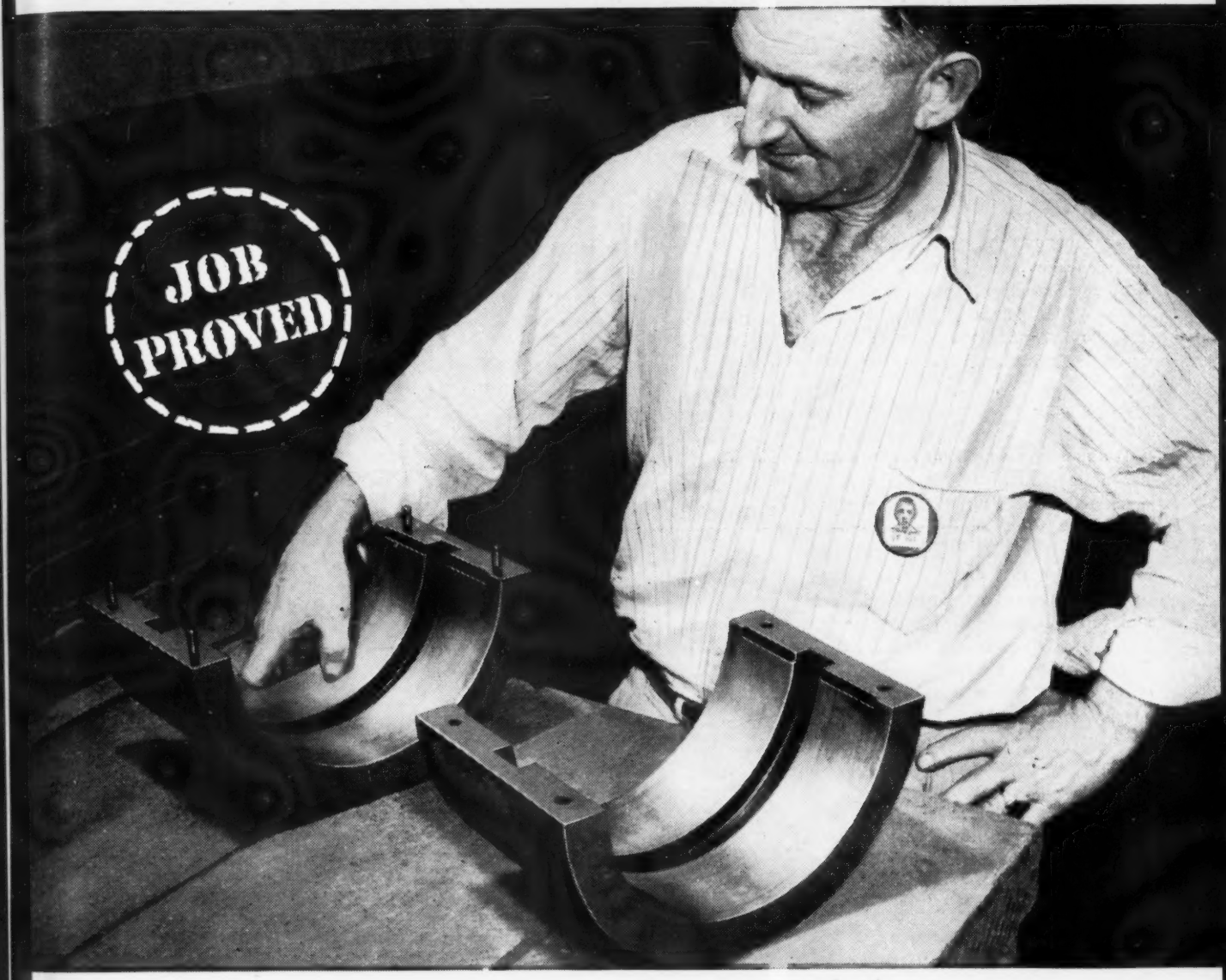
At full load, the energy component of the stator current is 23.6 amp and the magnetizing component 11.4; line current is about

$$\sqrt{23.6^2 + 11.4^2} = 26.2 \text{ amp}$$

Power factor would be $23.6 \div 26.2 = .90$, with a .03 air gap. With a gap of 0.046 line current would be 29.4, and power factor 0.8.

At half load, using similar calculations, power factor is .72 with a .03-in. air gap, and .56 with .046-in. gap. This does not take into account motor losses like I^2R loss, iron loss, windage and friction. The idea is simply to illustrate the effect of an air-gap change on power factor. The efficiency will also

Keeps His Bearings



SUN LUBRICANT . . .

Keeps Compressor's Main Bearings and Other Parts Like New for 20,000 Hours

The 400 horsepower, V-type, diesel-driven compressor in an Eastern shipyard operates normally on a 24-hour-a-day schedule. It has been lubricated with a Sun "Job Proved" oil from the day it was installed, and there has never been any lubrication trouble.

After 20,640 hours of almost continuous operation, the compressor was torn down for inspection. The main bearings, shown above, were checked and found to be in fine condition, with less than normal wear. All other parts were in the same state—practically as good as new.

The protection given to this compressor is typical of the results obtained in hundreds of plants with Sun "Job Proved" lubricants. For every type of modern power plant equipment, there's a Sun oil that's designed to give long, trouble-free service.

To reduce maintenance costs and to keep your diesels, turbines, compressors and other machines in operation longer, let Sun Engineers prescribe the correct lubricants. Call your nearest Sun office, or write Department P-3.

SUN OIL COMPANY • ***Philadelphia 3, Pa.***
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PRODUCTS

be slightly lower because of the increased current.

On one occasion I had a new motor in which the air gap was so small that, when the rotor expanded with heat, it rubbed on the stator and the motor stalled. Only remedy was to take a small cut off the rotor. **Alfred St. Laurent, Quebec Power Co, St. Raphael, Quebec.**

Don't Do It

BEFORE DISCUSSING what happens in a squirrel-cage motor after the rotor is turned down, let's review some magnetic theory. Air has a reluctance about 1000 to 2000 times greater than iron or steel. Therefore, considerably more ampere turns are needed to force a given amount of flux through air than steel.

If a motor is wound for a given number of ampere turns and the rotor is machined down, it requires more current to force the same flux through the larger air gap. Motor slip would also increase if rotor diameter were reduced.

If the rotor of a motor is removed and full voltage applied to the stator, it draws a large current from the line. Turning the rotor would have a similar effect, and the increased current would cause greater heating. The heating produced by the excess current does not increase in direct proportion, but as the square of the current. If the current is doubled, the heating is increased four times. Power factor of the motor would decrease along with its efficiency.

If a rotor has become damaged because of rubbing, smooth it up with a file but don't turn it down. **James J Anderson, St. Paul, Minn.**

Stator Winding Overheats

IN GENERAL, it is not advisable to take a cut from the rotor of a squirrel-cage motor. A cut increases the air-gap clearance. This results in a reduced starting torque, efficiency and power factor. Increased stator current would cause overheating of windings to pull the load.

These conditions are brought about by the high reluctance of the air gap. Higher current is required to force the magnetic flux through the longer gap. Unless the manufacturer is consulted, or suitable calculations made to show the effects of increased air-gap clearance, the cut should not be taken.

Better bearing maintenance and repair is an easier and more effective method of eliminating air-gap difficulties. An integrated inspection, maintenance and repair program prevents most bearing failures. Time spent on such work is well spent, since rotor repairs are reduced. **Tyler G Hicks, New York City.**

Turning Down the Rotor Will Increase Heating

HE ASKS ABOUT turning down motor rotors. My advice is don't do it. Turning down the rotor of an induction motor interferes with the electrical performance in several ways. Cutting action of the tool peens over edges of laminations so they make better electrical contacts with one another. This increases iron losses of the rotor and tends to cause more heating. This effect can be reduced by grinding with a fine wheel, but even this is to be discouraged.

Cutting down the rotor also lengthens the air gap. This increases the magnetizing current and might make the motor useless. Turning down the copper or aluminum rings increases rotor resistance. This decreases motor efficiency and causes local heating.

If *HE* has rotors that have been damaged as he describes, his money will be well spent if he throws them away and buys new ones. **Earl E Norman, manager, City Light and Water Utilities, Kalamazoo, Mich.**

Turning Induction Rotor Increases Starting Torque

HE IS FLIRTING with trouble if he makes a general practice of truing squirrel-cage rotors by taking off a cut. No one but the designer can actually tell how much the performance will be altered by machining the rotor. It may be possible to advise *HE* what to expect from a theoretical standpoint, but this may not always apply.

If *HE's* application isn't critical, he can turn down the rotor. I suggest, however, that he attempt to do his truing by reconditioning the bearings.

Cutting down rotor bars and end rings also reduces copper cross-sectional area, and at the same time increases the air gap. Decreasing copper area increases the rotor resistance, resulting in a greater I^2R loss. With greater loss the operating temperature is higher. The increased I^2R loss results in a lower efficiency.

Maximum torque occurs at higher values of slip because of the increased rotor resistance. The starting torque will be relatively greater since at standstill slip is maximum. The rotor reactance is lower because of the larger air gap and the increased rotor resistance. Maximum torque occurs when rotor resistance is equal to rotor reactance. This condition is approached when the rotor is turned down because the original reactance is decreased and the rotor resistance is increased. **K B Hoffman, electrical engineer, Tenafly, N. J.**

Consult the Manufacturer

THERE IS NO OBJECTION to turning down the rotor if *HE* is prepared to accept the changes in operating characteristics. Increasing the air gap will increase the no-load current, slip and power factor, and also decrease the torque per ampere.

The most satisfactory way to approach the problem is to present all details to the manufacturer, who can state definitely what the actual results will be. **C O von Dannenberg, Brooklyn, N. Y.**

Avoid Reducing Air Gap

INDUCTION MOTORS are designed with as small an air gap between rotor and stator as is consistent with good practice. By "good practice," I mean having enough clearance between the two elements so there is no danger of rotor rubbing on stator because of wear in the bearings. The current in the primary of an induction motor produces a rotating field, which travels around the stator. This flux links with conductors on the rotor and pulls them along, thus causing rotation.

The air gap has a high magnetic reluctance so that some magnetic lines do not cross into the rotor. In a wider gap, more of these magnetic lines fail to connect. Because fewer magnetic lines enter the secondary the power factor of the motor will decrease. Lower power factor means that more current is required to carry a given load resulting in increased motor heating. Before the war, some induction motors of European design were found to have extremely high power factor. The air gaps were found to be so small that unusual care and attention were required in checking the air gap from time to time to make sure the rotor did not rub on the stator.

With a transformer, there is no movement of secondary with respect to primary. Consequently, the primary and secondary coils can be interconnected with less magnetic leakage than is ever possible with an induction motor. As a result, we find that a 100-hp 1800-rpm induction motor has a pf of 88% whereas a comparable transformer might have a pf of 98%. **R F E**

(*Continued on page* 148)

Coming Events don't always

CAST THEIR SHADOWS...

Particularly in the Power Plant Field.

Plant Outage, for instance, can and usually does strike at any time *without warning.* But how many or *how few* shut-downs you have may depend entirely on the effectiveness of your water conditioning service.

Correct water conditioning is a matter of careful and scientific control.

W. H. & L. D. BETZ is an organization of engineers and chemists specializing in the solution of all industrial water problems. Years of experience have made Betz water conditioning service scientifically correct . . . complete . . . economical. Our staff of engineers will welcome the opportunity of discussing your boiler water problems . . . W. H. & L. D. BETZ, Gillingham and Worth Sts., Philadelphia 24, Pa. In Canada: Betz Laboratories Limited, Montreal 1.

BETZ

BOILER WATER CONDITIONING • COOLING WATER CONDITIONING • INDUSTRIAL WASTE TREATMENT

ENGINEER'S BOOKSHELF

BOOKS REVIEWED IN THIS ISSUE

INSTRUMENT AND CONTROL MANUAL FOR OPERATING ENGINEERS
THERMODYNAMICS • ELECTRICAL DISTRIBUTION FUNDAMENTALS
TROUBLES OF ELECTRICAL EQUIPMENT • ENGINEERING DATA BOOK
COLLOID SCIENCE • INDUSTRIAL APPLICATIONS OF INFRARED
ENGINEERING APPLICATIONS OF FLUID MECHANICS
ELEMENTARY ENGINEERING THERMODYNAMICS
COMPRESSED AIR HANDBOOK • LESSONS IN ARC WELDING
MAGNETIC CONTROL OF INDUSTRIAL MOTORS
AIR CONDITIONING AND ELEMENTS OF REFRIGERATION
HOW TO RUN A LATHE • JET PROPULSION PROGRESS
FLUID MECHANICS OF TURBOMACHINERY • AIR CONDITIONING
MANUAL FOR PROCESS ENGINEERING CALCULATIONS
PROCEEDINGS OF 1947 SMOKE PREVENTION ASSN CONFERENCE
PRACTICAL ELECTRICAL WIRING • INDUSTRIAL MANAGEMENT
STANDARD WELDING SYMBOLS AND RULES FOR THEIR USE

Instruments and Controls

INSTRUMENT AND CONTROL MANUAL FOR OPERATING ENGINEERS, *by Eugene W F Feller, associate editor of* POWER. (1947 *new*). 426 *pp*, 5½x8, *well illustrated, cloth*, $6. *McGraw-Hill Book Co*, 330 *W* 42*nd St, New York* 18, *N. Y.*

The book is a practical guide for the man in the plant who needs fingertip information for the quick and sound solution of specific metering and control problems. It explains the basic principles of control methods and describes the construction and operation of liquid level, pressure, temperature, and humidity indicators and controllers.

Considerable space is devoted to explaining the operating fundamentals of each primary element to give the reader a clear understanding of its physical characteristics. Separate chapters cover valves and piping and condensate-handling systems. Condensate removal goes hand in hand with control problems wherever steam is used as a heating medium.

Electric Distribution

ELECTRIC DISTRIBUTION FUNDAMENTALS (1947). *By Frank E Sanford, EE, director of research and development, Copper Wire Engineering Association.* 252 *pp*, 9½x6½, *illust, cloth.* $3.50. *McGraw-Hill Book Co*, 330 *W* 42*nd St, New York* 18, *N. Y.*

Intended primarily for men on the job, both in electrical distribution divisions of the utilities, and in the industrial wiring and commercial contracting branches of the broad field of distribution to the outlet. Emphasis is given to the everyday problems and their relation to the standards and practices that have followed many operating and economic comparisons in past development.

There are two principal changes in this edition, the second; a revision of the vector addition method and secondly an enlargement on the subject of transformer operation.

Fluid Mechanics

ENGINEERING APPLICATIONS OF FLUID MECHANICS (1947). *By J C Hunsaker, Department of Aeronautical Engineering, and B G Rightmire, Department of Mechanical Engineering, both of Massachusetts Institute of Technology.* 494 *pp*; 6x9; *tables; illust*, $5. *McGraw-Hill Book Co*, 330 *W* 42*nd St, New York, N. Y.*

The writing of this book aims at giving the reader a fundamental understanding of flow phenomena rather than a host of details about practical devices. Recent improvements in engine and machine efficiencies have resulted from better understanding of the conditions of flow, and not so much from relatively simple determinations of over-all performance.

Because of the increasing importance of controlled experiments in the development of machines a full discussion has been given of the theory of dimensions and physical similitude. Theoretical behavior of the ideal frictionless fluid introduces the basic concepts governing pressure and velocity distribution. To emphasize the simplicity of mathematical treatment and the validity of simplifying assumptions, more weight has been given hydro-mechanics and the boundary-layer theory than might be expected in an introductory text of this type.

To understand this text the reader should have had two years of college physics and mathematics, including differential equations, and one year of applied mechanics.

Heat Power

ELEMENTARY ENGINEERING THERMODYNAMICS, *third edition* (1947). *By V W Young, professor of mechanical engineering, Oklahoma Agriculture and Mechanical College, and G A Young, late head of the School of Mechanical Engineering, Purdue University.* 268 *pp*; 6x9; *tables, illust.* $3. *McGraw-Hill Book Co*, 330 *W* 42*nd St, New York* 18, *N. Y.*

This revision of the well-known text in heat power changes the emphasis on some applications of thermo developed during the war years and places greater stress on application to practical design. New material has been added in the discussion of Joule's Law, entropy, on the Brayton cycle and its application in the gas turbine, and in the introduction to supersaturation of nonequilibrium steam flow.

Compressed Air

COMPRESSED AIR HANDBOOK, *first edition*, 400 *pp*, 6x9, 247 *illust, simulated leather*, $3. *Compressed Air & Gas Institute*, 1404 *Terminal Tower, Cleveland, Ohio.*

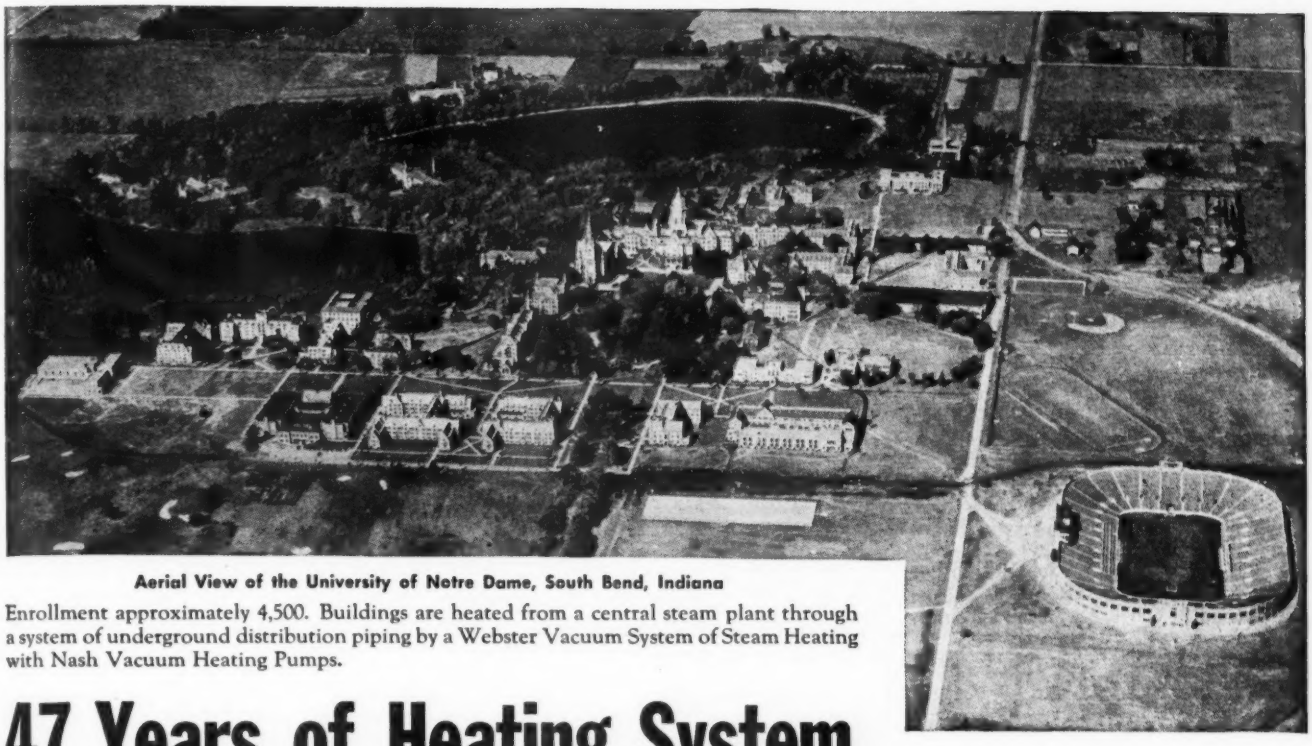
The handbook meets a widespread need for a reference text on application, installation, operation and maintenance of compressing equipment and airpowered tools. Revised and improved reference material was formerly published as "Trade Standards." The contents represent the collective knowledge and the experience of the 19 member companies of the Compressed Air & Gas Institute.

Air Conditioning

AIR CONDITIONING AND ELEMENTS OF REFRIGERATION (1947). *By Samuel P Brown, staff engineer, Coverdale & Colpitts, member, board of directors and formerly chief instructor, vocational div, Delehanty Institute, registered professional engineer, New Jersey & Ohio. With the editorial assistance of John D Constance, registered professional engineer, New York.* 644 *pp*, 6x9, *illust, tables, cloth* $6. *McGraw-Hill Book Co Inc*, 330 *W* 42*nd St, New York* 18, *N. Y.*

This book is based upon a textbook prepared for a resident course in air conditioning, conducted by the Delehanty Institute of New York for classroom training of students of high-school education or equivalent.

The text tells how to calculate heating



Aerial View of the University of Notre Dame, South Bend, Indiana

Enrollment approximately 4,500. Buildings are heated from a central steam plant through a system of underground distribution piping by a Webster Vacuum System of Steam Heating with Nash Vacuum Heating Pumps.

47 Years of Heating System Management at Notre Dame

A great university is, among other things, big business, receiving and disbursing large sums, maintaining and operating a large physical and mechanical plant. Consistent, competent management of the physical plant, such as is revealed by the record of heating system management at Notre Dame, is essential to success.

The first proposal for a Webster Vacuum System of Steam Heating at the University of Notre Dame was dated June 27, 1899—the installation, containing 16,913 square feet of radiation, was completed in 1900.

Thus started a cooperative business relationship that has continued for forty-seven years. During this period inevitably changes have occurred in architects, engineers, contractors, University plant personnel and Webster service personnel. But the service of this *business* institution to the University has been continuous. As new requirements arose, as additions and changes were made, as worthwhile new developments in the heating art became available, changes have been made in the University's heating installation to keep it up to date.

This great heating system now totals 320,000 square feet of radiation—twenty times the size of the original Webster Vacuum System. And each increase has been accompanied by appreciation of the increased importance of quality standards both in material and in operating and maintenance procedures.

Currently, to assure at the same time comfort with maximum economy of fuel and minimum operating and maintenance costs a Webster Moderator Control System is being installed, designed to (a) balance distribution so that all radiators may be partially heated in mild weather, (b) apply automatic control-by-the-weather to the entire installation, (c) centralize all manual control to 38 zones at a single operating station.

How well these results are accomplished must necessarily be the subject of a later report. In the meantime, our experience is available to *help you in your heating system management* problems.

WARREN WEBSTER & CO., Camden, N. J.
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Webster
HEATING SYSTEMS

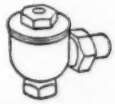
Webster Moderator System Equipment

Webster Metering Orifices, expertly sized, a vital feature of the Moderator System, balance distribution and make possible central control with continuous heating.

A single Webster Outdoor Thermostat Control automatically provides the lowest pressure for comfortable inside temperature in all zones at Notre Dame.

Special 38-Zone Central Control Panel for Notre Dame Moderator System Installation.

Webster Moderator Control Valve—38 installed at Notre Dame to provide continuous control of steam delivery in low pressure heating with remote shutoff.



Webster Thermostatic Radiator Trap — approximately 5,000 installed at Notre Dame.

and cooling loads and how to heat, cool, ventilate and condition air in any building. Selection of equipment, automatic controls, and the design of air ducts and liquid-piping systems are thoroughly covered. Not only is it an excellent reference book for those actively engaged in air conditioning and refrigeration work but it is also a valuable guide for those entering the field.

Heat Power

THERMODYNAMICS (*second edition*—1948). *By Lester C Lichty, professor of mechanical engineering, Yale University.* 341 *pp*, 6x9; 26 *tables;* 12 *charts;* 148 *illust.* $4.50. *McGraw-Hill Book Co,* 330 *W* 42*nd St, New York* 18, *N. Y.*

This revised edition maintains the original aim of minimizing mathematical manipulations in favor of emphasizing methods of fundamental analysis applied to energy relationships. The text has been largely rewritten to clarify the more difficult subjects.

A feature that students will welcome is the adoption of treating all energy elements as independent, positive quantities, eliminating the expression of energy components as the difference between that entering and leaving. This avoids confusion on the student's part in proper observation of mathematical signs. Tables for problem solution have been substituted for specific-heat equations, and solutions of $PV^k = C$.

The chapter on fluid flow includes the items of supersonic flow, Mach number, shock, jet propulsion, compressor and turbine blading, ram-chamber and diffusers.

Magnetic Control

MAGNETIC CONTROL OF INDUSTRIAL MOTORS (1947). *By Gerhart W Heumann, control engineering division, Apparatus Department, General Electric Co,* 589 *pp*, 9½x6½, *illust, cloth.* $7.50. *John Wiley & Sons, Inc,* 440 *Fourth Ave, New York* 16, *N. Y.*

Whereas the designer concentrates on a device, a circuit, or a mechanical arrangement of parts, the plant or operating engineer must have a knowledge of what control equipment can accomplish. This book answers that need by providing a coverage of electric motor performance, characteristics of control devices, and functions of commonly used control circuits.

Jet Propulsion

JET PROPULSION PROGRESS (1948). *By Leslie E Neville, director, Standard Aeronautical Index, Institute of the Aeronautical Sciences, and Nathaniel F Silsbee, colonel, Air Reserve.* 232 *pp;* 6x9; *illust;* $3.50. *McGraw-Hill Book Co,* 330 *W* 42*nd St, New York* 18, *N. Y.*

The development of the aircraft gas turbine is told in this little volume in simple and accurate terms. Known popularly as the turbo-jet and turbo-prop engines, they have initiated a revolution in airplane design. A detailed account is given of the possibilities and a comprehensive picture of initial experiments and development to date. Various designs produced in the United States, England and Germany are discussed and evaluated, including the ME262, which nearly turned the tide against the Allied air forces. The book includes an interesting 9-page chronology of aircraft gas turbines covering a period from 1917 to Dec 1946.

Electrical Troubles

TROUBLES OF ELECTRICAL EQUIPMENT (*third edition*, 1947). *By H E Stafford, electrical engineer, Marathon Paper Mills of Canada, Ltd.* 455 *pp*, 6x9 *in.*, 364 *illust,* 28 *tables, cloth.* $4.50. *McGraw-Hill Book Co,* 330 *W* 42*nd St, New York* 18, *N. Y.*

To locate and correct electrical troubles quickly is the mark of a good maintenance engineer. Here is material to help attain such proficiency. Several chapters have been rewritten and enlarged to bring the material up to date. Added are two chapters, two major and several minor tables, and 34 diagrams. Tables of troubles are handled much as a physician diagnoses a case. The symptoms being known, the trouble, cause and remedy are deduced.

Equipment treated includes: ac and dc motors and generators, transformers, air-break and oil circuit breakers, relays, motor control, lightning arresters, voltage regulators, cables and storage batteries. Other chapters cover method of connecting instrument transformers, pointers on selecting motors for industrial applications, insulation testing, power factor and its control, economical use of power, maintenance and inspection schedules, load surveys and how to make them, and industrial lubrication.

Many valuable tables diagnose troubles of specific equipment, giving symptoms, cause and remedy. A table is provided for practically every class of industrial electrical equipment. The author bases the book on nearly 40 years experience as an industrial-plant, operating, electrical engineer.

PUMP-CASING EROSION

In the following brief discussion, A L Sherman, chief engineer, The J S Coffin, Jr, Co, enters a dissent on one part of the article "Correct Materials Make Feed Pumps Immune to Corrosion-Erosion," by H L Ross (POWER, July, pp 86-88):

"While erosion-corrosion of multistage horizontally split steel-volute-case pumps has undeniably been troublesome in a great many instances, the writer feels that the broad claim made in one paragraph of Mr Ross's article is open to criticism." This paragraph is quoted as follows:

> Pump Design: Corrosion-erosion occurs in one design of feedwater pump as often as it does in another. It is associated with high liquid velocities but it is impossible to design a pump with velocities low enough to avoid the attacks.

"It should be pointed out that J S Coffin, Jr, Co manufactures centrifugal pumps employing, we believe, higher velocities than those of any other manufacturer; at least, we know of no other designs using impeller tip velocities in the neighborhood of 300 ft per second for lifts of approximately 1800 ft in one stage. Notwithstanding these velocities, we have not yet observed a single case of significant casing erosion-corrosion in a great many installations. Many of these plants had experienced erosion-corrosion difficulties with other centrifugal pumps.

Smoke Prevention

PROCEEDINGS OF THE 1947 CONFERENCE OF THE SMOKE PREVENTION ASSOCIATION, 120 pp, 8½x11; 17 *pp of illustration,* $2.50. *John Taylor, publisher, 520 Pleasant St, St. Joseph, Mich.*

Here in one volume are collected the 21 papers and the discussions of each, presented before the Smoke Prevention Association of America at its annual meeting in Toronto, July 1947. The association is comprised mostly of smoke inspectors for municipalities.

These papers are valuable for their technical content and for their indication of the scope of today's smoke-enforcement program, ranging from locomotives through all industries.

Authors of the papers are for the most part well-recognized leaders in their fields. For instance, Dr. L C McCabe, chief of coal div, U. S. Bureau of Mines, has a paper, "Observations Abroad," based on his experience in postwar Germany; C E Lesher, Disco Co, "Recent Progress in Smokeless Fuel Processing;" and E C Payne, consulting engineer, Pittsburgh Consolidation Coal Co, "Locomotive Fuel Performance."

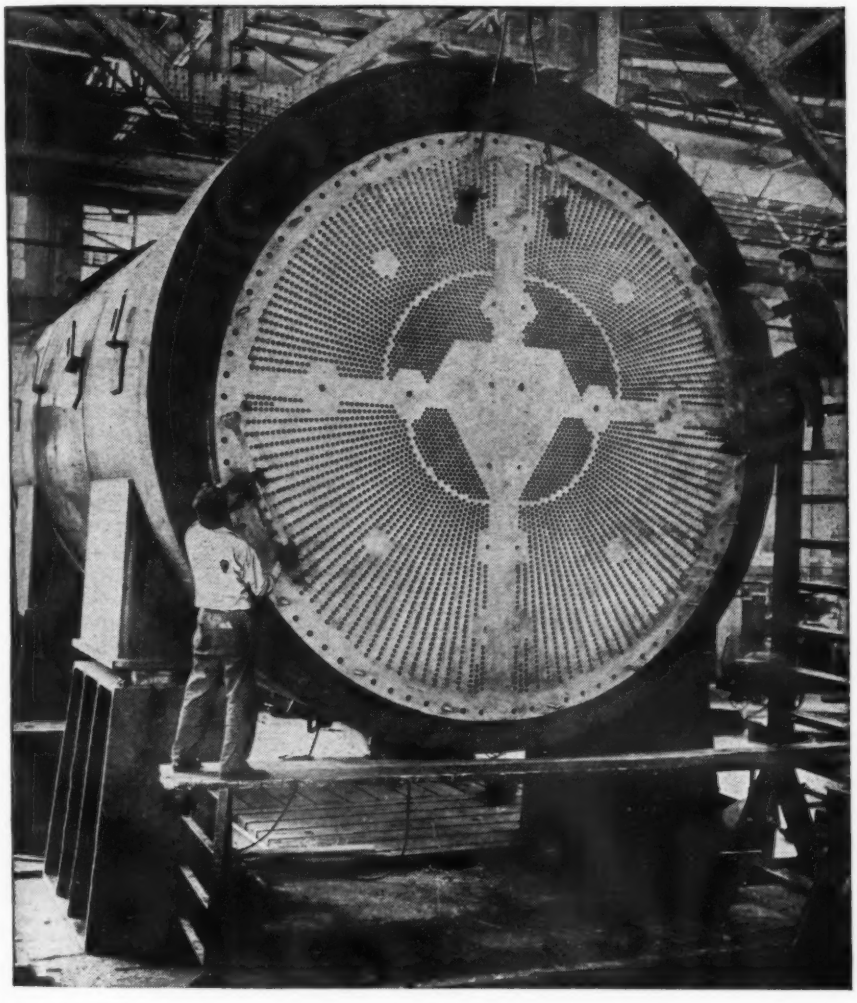
Process Engineering

MANUAL FOR PROCESS ENGINEERING CALCULATIONS (1947). *By Loyal Clarke, chemical engineer, Celanese Corp of America.* 438 *pp;* 6x9; *charts, tables, illust;* $6. *McGraw-Hill Book Co,* 330 *W* 42*nd St, New York* 18, *N. Y.*

Here are compiled data useful in making quick, preliminary calculations concerning chemical processes from the research to the final design stage. The book contains self-explanatory tables, charts and equations which are the most used in process engineering. Material covers conversion factors, physical and mechanical properties, equipment performance factors and

(*Continued on page* 140)

★16,280 pounds of Anaconda Copper Tube Sheet go into this Westinghouse Condenser



WORKMEN are shown installing one of two 8,140 lb. copper tube sheets in a giant condenser being built by the Westinghouse Electric Corporation of Philadelphia, Pa. for the Public Service Company of Oklahoma, Tulsa, Oklahoma. The plates for these tube sheets, measuring 12′ 9″ high and 1⅜″ thick, were produced at the Detroit Mill of The American Brass Company. The completed condenser will contain 5,200 tubes—and will have a 32,500 sq. ft. capacity.

Anaconda Electrolytic Tough Pitch Copper is desirable because of the high alkaline content of the Tulsa water supply.

Anaconda Rolled Plates and Circles for condenser tube sheets are unsurpassed in soundness and close grain structure. They can be supplied in rectangles, squares, circles, ovals, segments and sectors thereof. Plates are regularly manufactured in widths up to 156″ (circles up to 160″ diameter) and in weights up to 9,000 lb. and heavier—depending on the alloy and shape.

In determining the most suitable alloys for tubes and tube sheets, equipment manufacturers are invited to consult our Technical Department. Publication B-2 available on request.

47180

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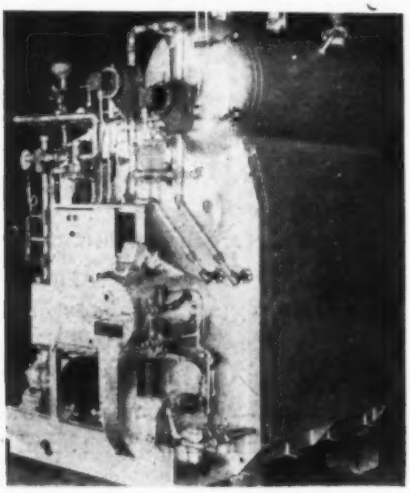
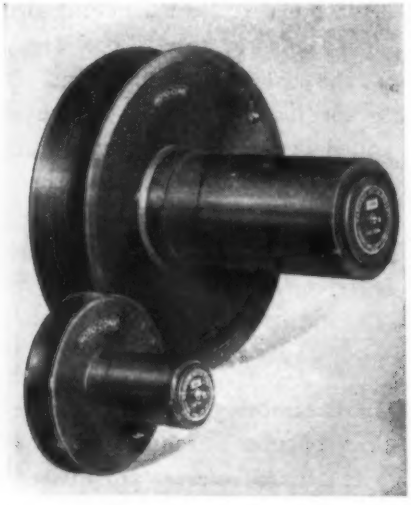
NEW PLANT EQUIPMENT



Package Boiler E74

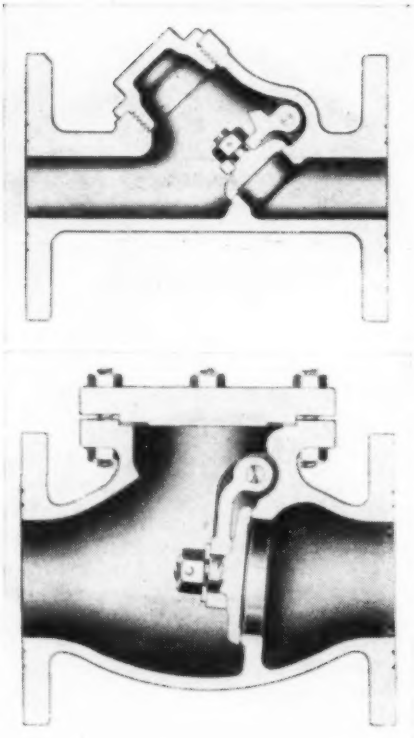
FACTORY-ASSEMBLED, complete to refractory and insulation, package boiler comes in capacities up to 27,000 lb per hr of steam in two pressure classes (1) up to 250 psi (2) up to 850 psi.

Design permits installation of a superheater as original equipment or for later addition. Integral combustion controls give full or semiautomatic operation and allow use of a central control panel. **Foster Wheeler Corp, 165 Broadway, New York, N. Y.**



V-Belt Sheaves E75

VARIABLE-PITCH V-belt sheaves, rated ⅛ to 7.5 hp, have a double rack and pinion to keep movement of the two sheave faces equally spaced at all times. A single spring provides necessary pressure for proper belt tension. Constant belt centerline is maintained to allow use of a V-groove driven sheave. Mounting may be either vertical or horizontal. All sizes have speed changes within 3 to 1 ratio, except the ⅛-hp size, which is 2¼ to 1 ratio maximum. **Gerbing Mfg Corp, 154 E Erie St, Chicago, Ill.**

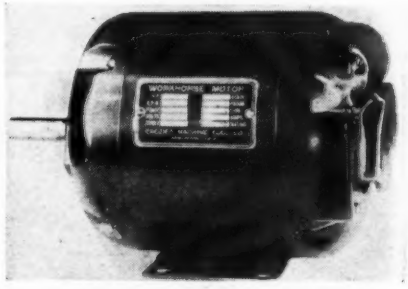


Swing Check Valve E76

CORROSION-RESISTANT swing check valves, in sizes from ¼ to 6 in., are made in both 18 and 8 *Mo* alloy steel and monel metal. Sizes ½ to 2 in. have screwed or flanged ends, and sizes 2½, 3, 4 and 6 in. have flanged ends only. In sizes ½ to 2 in., the body is made in a Y pattern and the cap is on same center line as seat opening. In the 2½-, 3-, 4-, and 6-in. sizes, the body is the straightway type, with seat placed at only a slight angle from vertical. The 2½- to 6-in. sizes can be furnished with an outside lever and weight, which can be applied to assist either in closing or opening. The valves are recommended for liquid or gas working pressures up to 150 psi and for maximum temperatures of 350 F. **Crane Co, 836 S Michigan Ave, Chicago, Ill.**

Compressed-Air Cooler E77

INTEGRAL-CAST finned radiation element provides aftercooling for compressed air under normal atmospheric conditions. Manufacturer says the cooler will precipitate up to 85% of the moisture in compressed air. Any number of individual radiation units can be connected together to form an aftercooler of the required size. **Wilson Engrg Corp, 122 S Michigan Ave, Chicago 3, Ill.**



Capacitor Motor E78

SAID TO BE THE LIGHTEST of its size, rating and capacity, this motor is for heavy-duty, single-phase, ½-hp, 115-230-v operation. Because of low slippage, the 2-pole unit develops 3520 rpm, and the 4-pole unit, 1760 rpm. It draws only 6.8 amp on 110 v, and 3.4 amp on 220 v. Light weight is due to aluminum brackets and simplicity of construction. Called the *Workhorse*, this motor operates on either 50 or 60 cycles; it also has lifetime-lubricated sealed ball bearings. A highly efficient cooling system constantly circulates air between frame and laminations. Windings are made of heavy *Formvar* insulated wire. Starting torque is 220%, and the motor can withstand 25% overload indefinitely. **Crozier Machine Tool Co, Hawthorne, Calif.**

Impact Wrench E79

NEW SPEED-O-MATIC electric torqueless impact nut setter is torqueless and will not twist in operator's hands when the nut gets tight. Device drives the nut or bolt 1750 rpm at free speed. At point of resistance,

Use convenient reply cards on page 176a to secure additional information on these new equipment items. Please be sure to identify your request with the new-equipment key letter, *E*, and number, as shown on the items above.

Steam . . . water . . . oil . . . or gas
CRANE Supplies all Piping equipment

. . . A good thing to remember for a simplified piping job every time . . . on new or replacement installations. No matter what the fluid or working conditions, see the Crane line first for *all* piping equipment . . . and for dependable quality in every item.

For this water supply system, for example, the Crane Catalog puts everything at your finger tips . . . valves, fittings, pipe, and pipe line accessories. One order to your Crane Branch or Wholesaler covers all your needs. From design to erection to maintenance, your piping job moves fast and smooth . . . with good performance assured . . . because you get this 3-way advantage:

ONE SOURCE OF SUPPLY offering the world's largest selection of steel, iron, brass and alloy piping materials for all power, process, and general service applications.

ONE RESPONSIBILITY for piping materials—helping you to get the best installation, and to avoid needless delays on the job.

OUTSTANDING QUALITY in every item—assuring uniform dependability and durability throughout piping systems.

CRANE CO., 836 S. Michigan Ave., Chicago 5, Ill.
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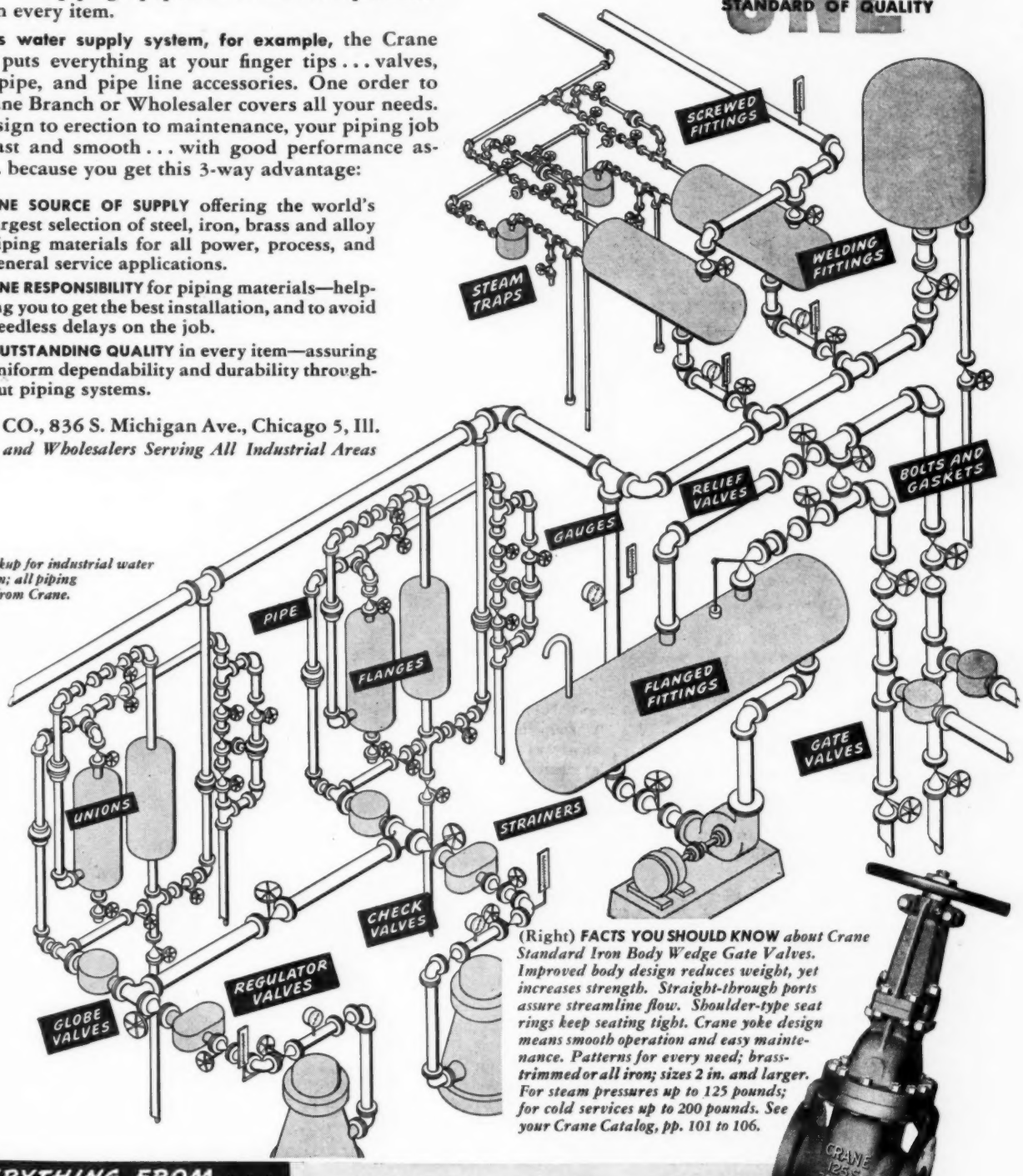
STANDARD OF QUALITY



Typical hookup for industrial water supply system; all piping equipment from Crane.

(Right) **FACTS YOU SHOULD KNOW** *about Crane Standard Iron Body Wedge Gate Valves. Improved body design reduces weight, yet increases strength. Straight-through ports assure streamline flow. Shoulder-type seat rings keep seating tight. Crane yoke design means smooth operation and easy maintenance. Patterns for every need; brass-trimmed or all iron; sizes 2 in. and larger. For steam pressures up to 125 pounds; for cold services up to 200 pounds. See your Crane Catalog, pp. 101 to 106.*

EVERYTHING FROM . . .

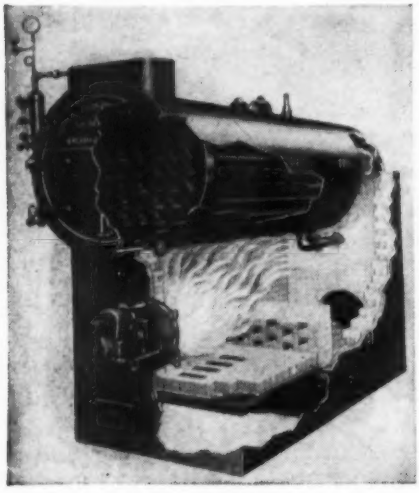
VALVES • FITTINGS
PIPE • PLUMBING
AND HEATING

CRANE

FOR EVERY PIPING SYSTEM

Equipment *Continued*

impact unit automatically delivers 3000 impact blows per min. Unit is instantly reversible. Equipped with 25 ft of rubber-covered cord, plug and ground wire, it operates on any 110-v, 60-cycle ac or dc circuit. The unit has an over-all length of 12½ in. and weighs 13½ lb. It has a capacity up to ¾-in. bolts and nuts. Device is made of *Silman* steel forgings for maximum endurance and is equipped with precision ball and roller bearings. **Illinois Gage Co, 7810 W Addison St, Chicago 34, Ill.**



Package Boiler E80

AUTOMATIC, HRT PACKAGE BOILER, with full-length refractory-lined firebox shipped completely bricked and insulated, comes with either a gas or oil burner and grates for coal-firing to permit overnight conversion to alternate fuel.

Economist Dual-Fired unit can change from one fuel to another, states the manufacturer, by removing bricking and insulation from top of grates when changing to a non-solid fuel. **C H Dutton Co, 630 Gibson St, Kalamazoo, Mich.**

Hydraulic Crane E81

MOBILE HYDRAULIC CRANE lifts and carries up to 3 tons, has 10 ft of vertical boom travel and cable travel of 16 ft. Maximum clearance under hook is 18 ft, 6 in. Sidewise boom movement is limited to assure stability when handling maximum load. All crane movements are readily controlled by one man from the driver's seat through simple system of precision hydraulics. Half-track chassis works effectively on almost any kind of terrain from factory floor to rutted mud. It operates at speeds up to 40 mph. In addition to lifting and carrying, the unit is equipped to do towing and pushing operations. **Day-Smith Hydraulic Crane Corp, Camp Hill, Pa.**

Steam Trap E82

CUB-JR STEAM TRAP may be suspended in a horizontal run of pipe without other support. Screwed inlet and outlet connections are furnished in sizes ½ and ¾ in. Trap will handle up to 2000 lb of condensate per hr on continuous discharge. At 60 psi the rating is 960 lb per hr. Valves are accessible and may be changed for various pressures without other adjustment. Valves and seats are interchangeable in the full range of trap sizes within a common pressure range. Maximum pressure for the *Cub-Jr* is 125 psi. Body of the trap may be unbolted and removed without disturbing pipe connections. **Wright-Austin Co, 315 W Woodbridge St, Detroit 26, Mich.**

Air Circuit Breaker E83

DESIGNED FOR low-voltage circuits, this circuit breaker is available in two current ratings, at 600 v and below. *AK*-1-15 is rated 15 to 225 amp, and *AK*-1-25 is rated 35 to 600 amp, with 15,000- and 25,000-amp interrupting ratings, respectively.

Features of the breaker include improved arc interruption, accessories readily attached in the field, compact, sealed-in overload trips, short time rating equal to interrupting rating, and an arcing time less than one cycle. Interchangeable dual magnetic trips have accurate sealed-in liquid-displacement time-delay devices using silicone fluid. Because of accuracy of trip units this breaker is suitable for selective tripping. **General Electric Co, Schenectady 5, New York.**

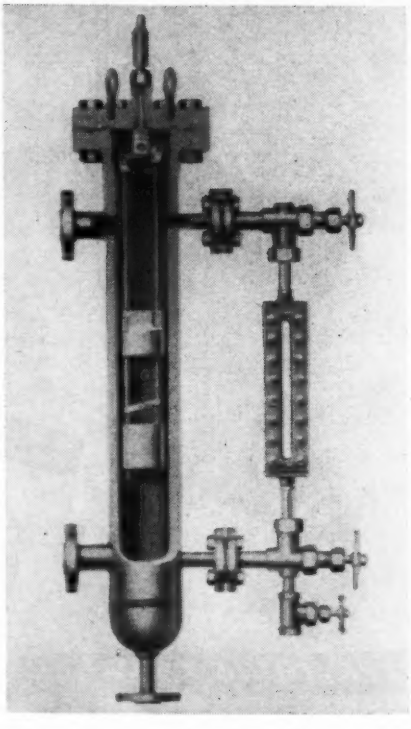
Capacitor Motor E84

CSI CAPACITOR-START, fractional-horsepower motors have triple-seal windings and high-starting torque characteristics. Rotor is of all-welded pure-copper-bar construction. Motor is of splashproof design with sturdy

You Can't Blow Your Low-Water Whistle Upside Down!

We tried it and we know. Back last fall, we sent a cut showing a water column to the print shop with careful instructions as to which side was "up." Knowing the ways of makeup men with cuts that look nearly as good one way as another, a silent prayer went with the instructions. To no avail, because the inevitable happened and the November issue carried the picture with the water whistle blowing down. Still game, we tried again in the Mid-December review of new equipment. The score—no hits, no runs, *two* errors. Don't ask how our eagle-eyed proofreaders missed it—maybe they liked the way it looked, "wrong end to," or maybe they're saboteurs.

Slightly punch-drunk by this time, we're making one last effort. Ladies and gents, if we haven't been crossed up again the cut at the right shows the water column in the generally accepted position—the one in which the whistle blows instead of acting as a drain cock. This column, the right-side-up one, is made by Jerguson Gage & Valve Co, long-suffering and patient gentlemen!



Use convenient reply cards on page 176a to secure additional information on these new equipment items. Please be sure to identify your request with the new-equipment key letter, *E*, and number, as shown on the items above.

REVERE detects *VIBRATION* at a distance

DO you know that vibration can be present in the tubes of a condenser, though not perceptible in the shell? Putting the palm of your hand on a condenser is not a good test for destructive vibration. The best test is one carried out in the Revere Research Laboratory in Rome, N. Y., which makes a microscopic examination of the metal as a part of its work in determining causes of tube failure. If vibration contributed to short life, this examination will show it. Vibration accelerates corrosion in several ways. The alternating stresses in time produce cracks across the grain of the metal, weakening it and giving corrosive fluids more points to attack. Vibration also breaks or disrupts or disturbs the thin film on the surface of the metal that protects it and helps reduce the rate of corrosive attack. Of course vibration is but one of a number of factors influencing the service life of condenser tubes, and so when tube life is questioned we always suggest that samples from failed tubes be sent to us. We may be able to help you, as we have others, with suggestions that should materially extend the period between re-tubings.

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230 Park Avenue, New York 17, New York

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Equipment *Continued*

steel frames and die-cast aluminum alloy end bells with cast-in terminals for easy wiring. Motors are available in ratings of ⅛, ¼, ⅓ and ½ hp, single phase, 60 cycle, 115-230 v. These motors serve with conveyors, stokers, pumps, etc. **Torq Electric Mfg Corp, 1091 Interstate St, Bedford, Ohio.**

Welding Electrode E85

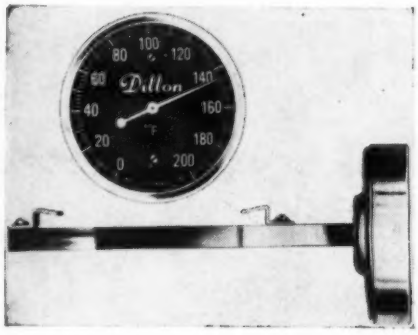
HOBART SOFTCAST A is a copper nickel alloy electrode having a mineral flux coating for metallic arc welding. It is especially adapted for welding cast iron where weld area must be machined, drilled or tapped. Electrode is available in 3/32, ⅛, 5/32 and 3/16-in. diameters in 18-in. lengths. **Hobart Brothers Co, Hobart Square, Troy, Ohio.**

Tube Cleaner E86

MODEL CC-450 Airetool cleaner is for cleaning scale from condenser and heat-exchanger tubes from ¾ to 1½ in. ID. Outer case is of lightweight aluminum alloy. All moving parts are alloy steel, heat treated to insure uniform grain and hardness. A convenient handle valve affords operator positive control of the direct-drive air- or steam-driven motor. Flushing agent is introduced through motor and drive shaft to cutting edges to insure a cool drill and to flush out removed deposits. Various designs of cutters and drills are available. **Airetool Mfg Co, 334 S Center St, Springfield, Ohio.**

Valve Packing E87

CHEMISEAL No. 510 material is a chemically inert, anti-adhesive and easily deformable valve packing. Fabricated from 100% unoriented *teflon*, the packing is inserted into valve stuffing boxes in form of a sleeve or bushing, and with low nut pressure flows to dimensions of stuffing box. Packing is available in a wide range of diameters and lengths. **U. S. Gasket Co, 610 N. 10th St, Camden, N. J.**

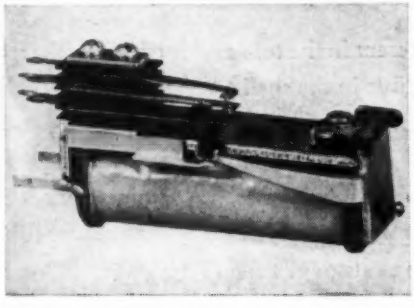


Dial Thermometer E88

DILLON DIAL THERMOMETER has a flat stem that clamps on flat or rectangular surfaces, for example, on power busbars, switch blades, engine blocks, water jackets, etc. It can be clamped in any desired position. Stems are available in varying widths, thicknesses and lengths in a wide range of metals. Capacities are 0 to 200, 50 to 500, 150 to 750, and 200 to 1000 F. Three- and 5-in. dials are standard, and centigrade scales may be had on order. **W C Dillon & Co, 5410 W Harrison St, Chicago 44, Ill.**

Lamp Ballast E89

DESIGNED FOR GREATER FLEXIBILITY in planned lighting, two groups of ballasts for *Slimline* fluorescent lamps are available in both single-lamp and *Tulamp* high power-factor units. They are for operation at current values of 120- and 300-ma. Ballasts are also available for single-lamp and *Tulamp* cold-cathode lamps. These cold-cathode lamp ballasts operate the 72T8 and the 96T8 lamps at 120-ma. **General Electric Co, Schenectady 5, N. Y.**



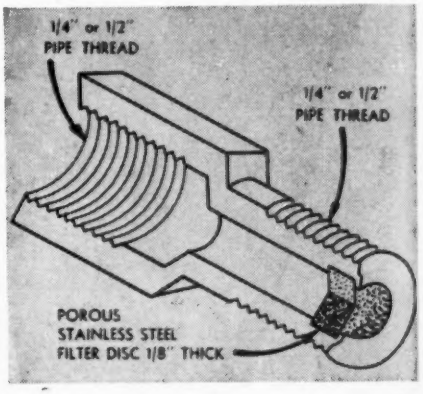
Multi-Contact Relay E90

CAPABLE OF HANDLING as many as 12 circuits in a wide variety of contact combinations, this relay is for industrial electronic apparatus, communication and signaling equipment. It has a life expectancy of millions of operations. Working from five basic contact arrangements, contact combinations can be stacked to satisfy many intricate circuit-switching requirements. Silver, palladium or tungsten contacts can be supplied. The choice depends upon rating and life specifications.

More than 500 different coils are available for use in the relay, with ratings from 1 to 250 v and from 0.1 to 26,000 ohms. **General Electric Co, Schenectady, 5, N. Y.**

Flat Paints E91

RUBBER-BASED, self-sealing, flat-finish paint that brushes equally smooth over painted or unpainted work—over wallboard, brick, concrete, smooth or rough plaster, oil-resin-emulsion paints, even over wallpaper—are some of the claims its manufacturer states. *Paratex* wall coating can be applied by brush, roller or spray. **Truscon Laboratories, Detroit, Mich.**



Pressure Snubbers E92

EQUIPOISE SNUBBERS eliminate pressure fluctuations caused by pressure pulsations and vibration. Porous stainless-steel filter disks provide a relatively large filter surface to prevent clog-up. Filter disks are available for air, oil, water, mercury, etc. Maximum differential-pressure rating of the standard types is 500 psi. Snubbers for use up to 5000-psi differential pressure can be supplied. **Equipoise Controls, Inc, 100 Stevens Ave, Mt. Vernon, N. Y.**

Phase-Shifting Transformers E93

THESE ADJUSTABLE phase-shifting transformers convert standard watthour meters to kva-hr units by displayed voltage method. Transformers shift voltage by 0, 30, 45 and 60 deg, corresponding to 100, 86.6, 70.7 and 50% power factor, respectively, depending upon position of movable plug inserted in radio-type sockets built into unit.

Use of these transformers is based on

(*Continued on page* 152)

Use convenient reply cards on page 176a to secure additional information on these new equipment items. Please be sure to identify your request with the new-equipment key letter, *E*, and number, as shown on the items above.

Evidence

OF RESULTS FROM NALCO WATER TREATMENT IN THE PAPER INDUSTRY

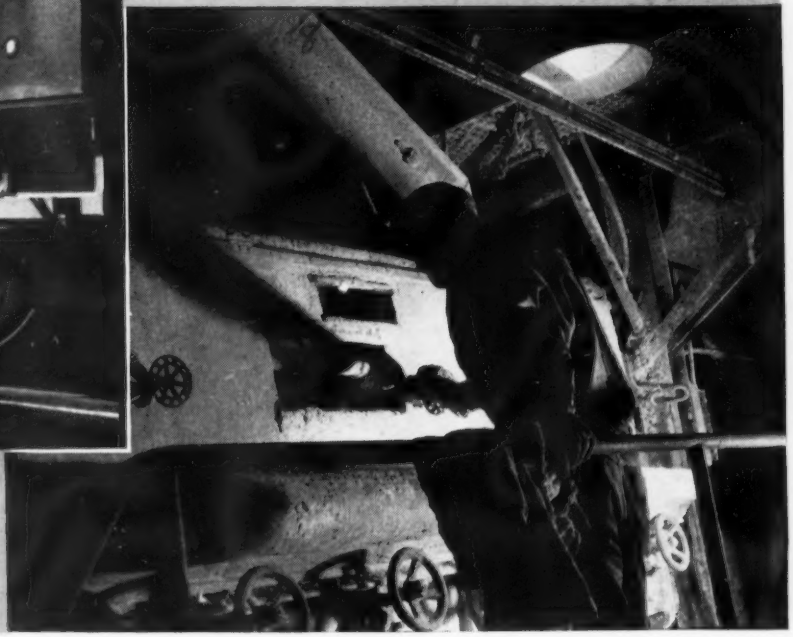
77.2% of Nalco paper mill clients have employed the Nalco System for over 5 years;

33% have relied upon Nalco for over 10 years;

59% of mills in the over-10-year group have benefited from Nalco Water Treatment for more than 15 years.

Here's proof that the Nalco System consistently produces savings year after year. You can secure *permanent* water treatment results in your plant by putting Nalco research, field service and chemicals to work for you. Write today for information.

The world's finest water treatment laboratories assure users of the Nalco System a successful and continuous solution to any and all water treatment problems.



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—the Scientific System of Water Treatment for All Industry

How to plan

HIGH PRESSURE STEAM CONNECTIONS TO LAUNDRY EQUIPMENT

Another in the series of basic Piping Layouts prepared by Jenkins Bros.

Typical steam connections to air drying tumblers, flatwork ironers, and power steam presses, commonly used in commercial or institution laundries, are illustrated in this layout.

The tumbler illustrated here is equipped with three independent heating coils over which air is passed and heated before entering the tumbler proper. Check valves on the coil outlets prevent any backflow if an outlet valve is left open when the coil is shut down.

All steam feeds to equipment are individually trapped so that accumulated moisture can be removed before steam goes into the equipment. Each trap is provided with a free blow by-pass and a bronze globe trap test valve marked "H". The free blow line assures uninterrupted operation during trap maintenance or the starting up period after a long shutdown.

Several Types and Pressure Ranges of Jenkins Valves, other than those shown, can be used for this type of layout, according to the factors involved. Consultation with accredited piping engineers and contractors is recommended when adapting these suggestions to your own requirements, or when planning any major piping installations.

Jenkins PRACTICAL PIPING LAYOUTS

Illustrating the proved 3-point formula for trouble-free, time-defying hookups

A Use the right type valve for the service.
B Place valves correctly in the line.
C Choose Jenkins Valves for lifetime economy.

32

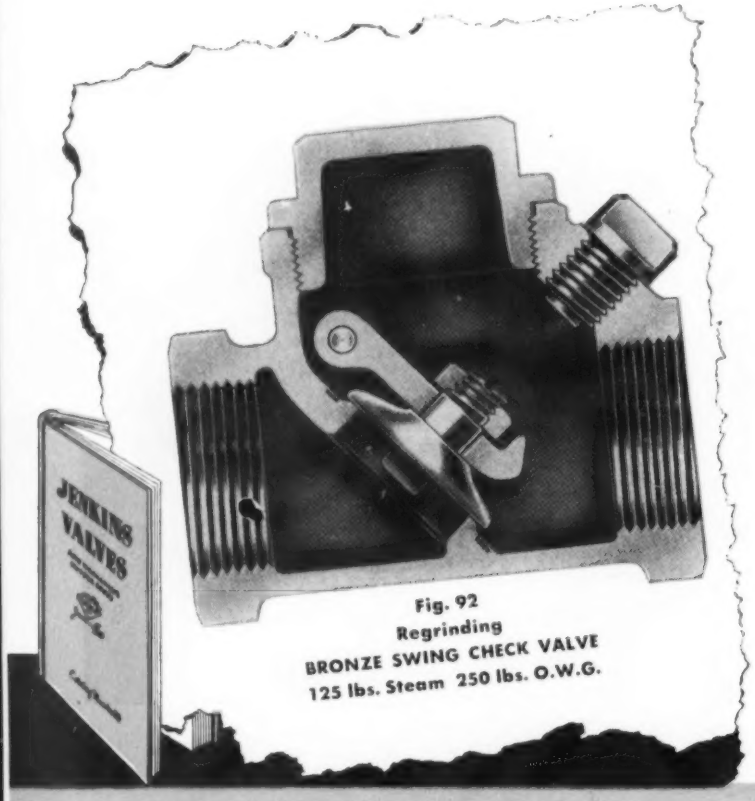


Fig. 92
Regrinding
BRONZE SWING CHECK VALVE
125 lbs. Steam 250 lbs. O.W.G.

Copies of Layout No. 32 will be furnished on request. Just fill out and mail the coupon.

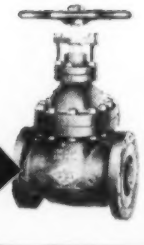
Fig. 92, the Bronze Swing Check Valve recommended in this layout is exceptionally serviceable for the non-return control of steam up to pressures of 125 lbs., and non-shock cold oil, water, and gas up to 250 lbs. It is particularly suitable for condensate and return lines, as well as for feed and oil line service—but it is not recommended where flow pulsates violently. The high tensile bronze disc is carefully machined to a smooth, tight-fitting finish, and can be reground easily without removing the valve from the line.

A CHOICE OF OVER 500 JENKINS VALVES

To save time, to simplify planning, to get all the advantages of Jenkins specialized valve engineering experience, select all the valves you need from the Jenkins Catalog. It's your best assurance of *lowest cost in the long run.*

Jenkins Bros., 80 White Street, New York 13; Bridgeport, Conn.; Atlanta; Boston; Philadelphia; Chicago; San Francisco.
Jenkins Bros., Limited, Montreal.

JENKINS VALVES



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125 TO 600 LBS. STEAM PRESSURE

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HIGH PRESSURE STEAM CONNECTIONS TO LAUNDRY EQUIPMENT

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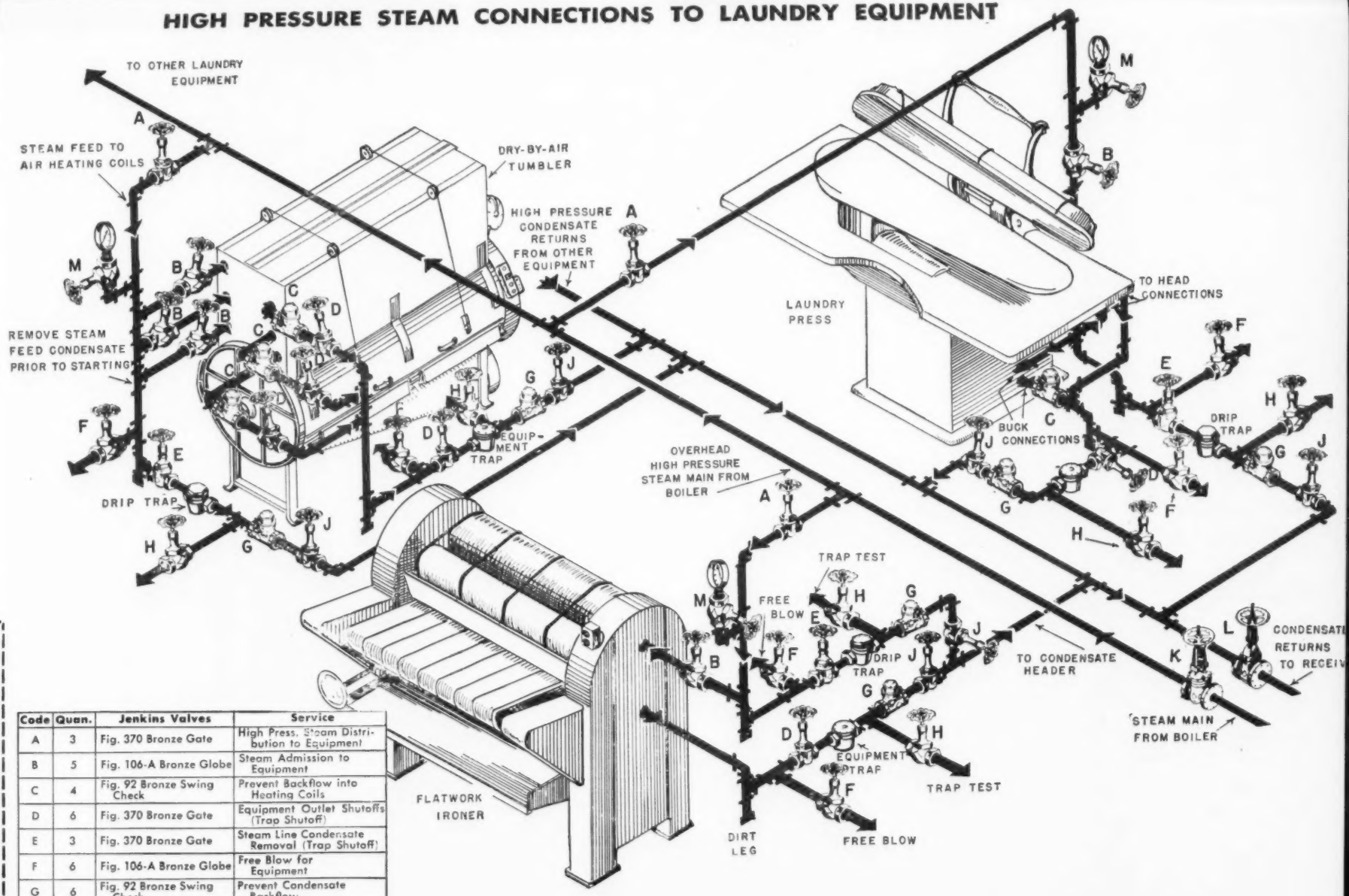
FOR EVERY INDUSTRIAL, ENGINEERING, MARINE, PLUMBING-HEATING SERVICE
SOLD THROUGH RELIABLE INDUSTRIAL DISTRIBUTORS EVERYWHERE

HIGH PRESSURE STEAM CONNECTIONS TO LAUNDRY EQUIPMENT



Code	Quan.	Jenkins Valves	Service
A	3	Fig. 370 Bronze Gate	High Press. Steam Distribution to Equipment
B	5	Fig. 106-A Bronze Globe	Steam Admission to Equipment
C	4	Fig. 92 Bronze Swing Check	Prevent Backflow into Heating Coils
D	6	Fig. 370 Bronze Gate	Equipment Outlet Shutoffs (Trap Shutoff)
E	3	Fig. 370 Bronze Gate	Steam Line Condensate Removal (Trap Shutoff)
F	6	Fig. 106-A Bronze Globe	Free Blow for Equipment
G	6	Fig. 92 Bronze Swing Check	Prevent Condensate Backflow
H	6	Fig. 106-A Bronze Globe	Trap Test
J	6	Fig. 370 Bronze Gate	Condensate Returns to Header (Trap Shutoff)
K	1	Fig. 142 IBBM Globe	Steam Header Shutoff
L	1	Fig. 651 IBBM Gate	Condensate Return Header Shutoff
M	3	Fig. 106-A Bronze Globe	Pressure Gage Shutoff

VALVE RECOMMENDATIONS
For details and valves to suit varying conditions see Jenkins Catalog

Diagram by Huxley Madeheim
Consulting Engineeer

JENKINS BROS., 80 White St., New York 13, N. Y.

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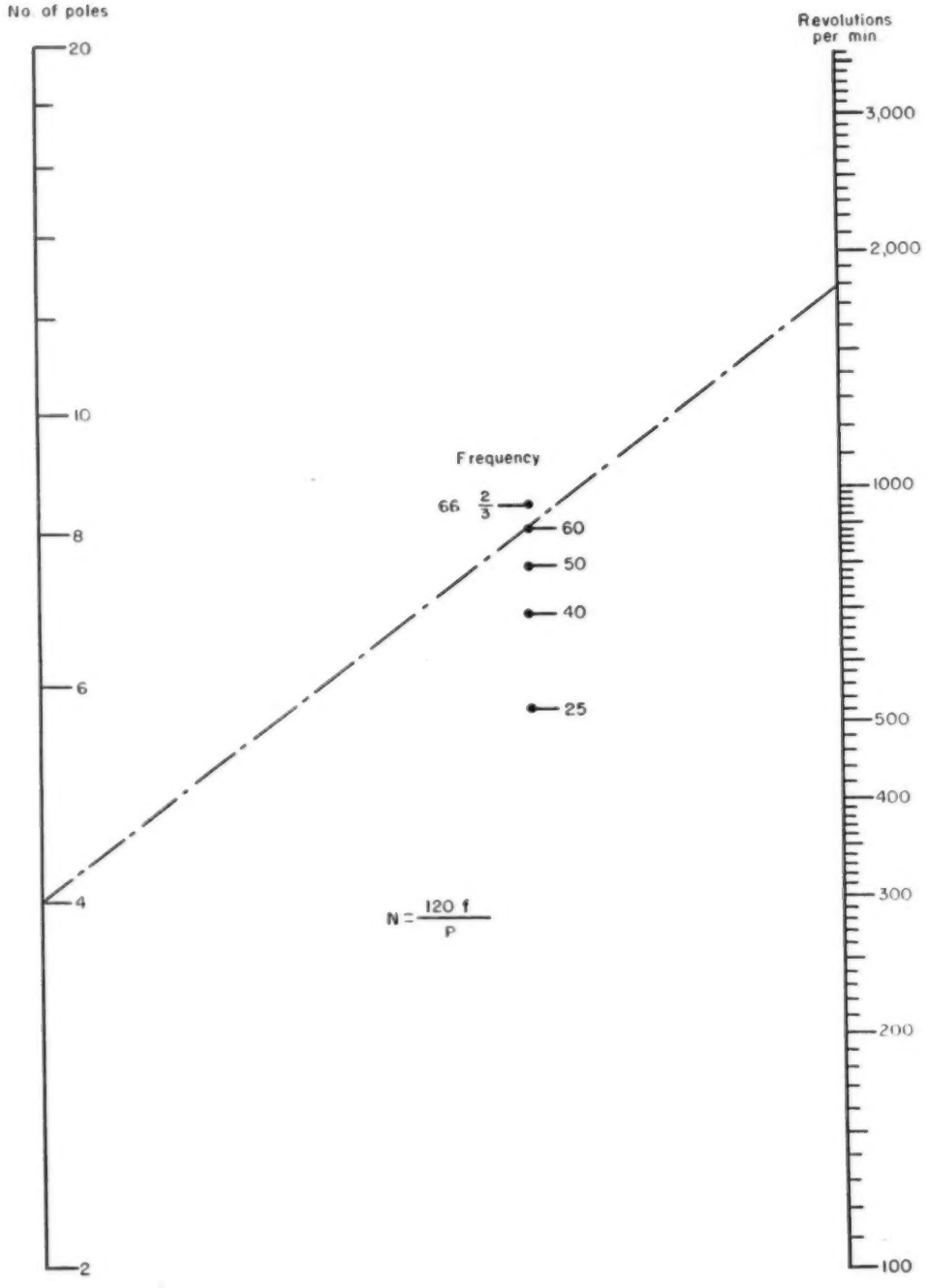
Number 188

Synchronous Speeds of Electrical Machines

By JOHN HYAM



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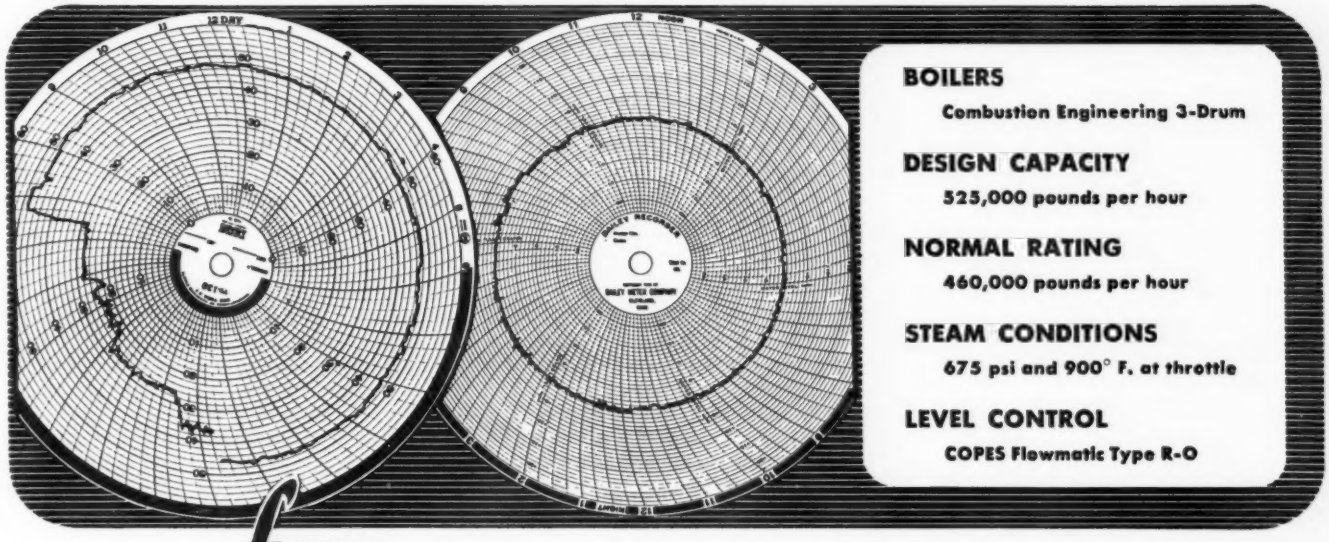

BOILERS
Combustion Engineering 3-Drum

DESIGN CAPACITY
525,000 pounds per hour

NORMAL RATING
460,000 pounds per hour

STEAM CONDITIONS
675 psi and 900° F. at throttle

LEVEL CONTROL
COPES Flowmatic Type R-O

From **460,000 down to 320,000 pounds per hour in 15 minutes . . . 280,000 up to 400,000 pounds an hour in another 15 minutes . . . and level held closely . . .**

No matter how rapidly or widely your boiler load changes, you can be sure of a stable water level in the drum if you depend on COPES Flowmatic for boiler feed control. Users also say adjustments and maintenance are easy for the plant personnel.

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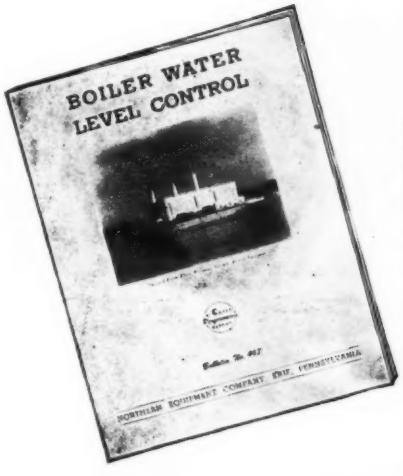
BRANCH PLANTS in Canada, England, France and Austria
Representatives Everywhere



Charts above are from Performance Report, Bulletin 467. Write for your copy today.

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PIPING, SUPPORTS

An Unusual Defect in a Boiler Support, *by Vulcan Boiler and General Insurance Co.* A 228,000-lb-per-hr steam-generating unit revealed on inspection a deterioration of the vertical web of the main girder, Fig. 1.

This 5 ft, 2 in. girder is the built-up I-section type, Fig. 1, fitted with vertical stiffener angles on both sides of the web. It spans 31 ft.

One side opens on the boiler room. The other faces the fire, behind a sheet-metal casing that runs the length and width of the girder, leaving a 6-in. air space between casing and girder, Fig. 2. The plate had no ventilating holes.

Corrosion reduced the vertical web plate at the upper part from ½ to ⅛ in. in many places. In a few places corrosion had penetrated the plate. The vertical stiffener angles on the fire side had been reduced to paper thickness or completely wasted away. No deflection of girder alignment was detected. Fortunately the girder, built for 250-ton loading, had to carry only 70 to 80.

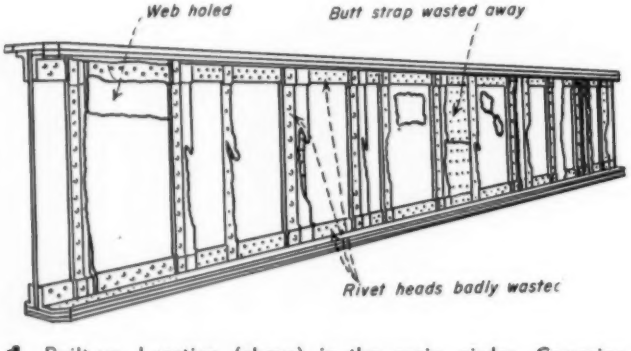
Two samples of scale and dust were taken. Both showed oxides of iron and were strongly magnetic. There seemed to be no trace of acid. The second sample did show silica, apparently from flue gas.

To prevent a recurrence an air space in the fire side of the girder has been provided. Plates ¼ in. thick form the casing. They are protected by a 17-in. refractory wall. Several 1-in. holes drilled in the web plate of the girder allow ventilation within the air space. Sight holes, 9 in. dia, have been cut in for inspection. *Vulcan Magazine, July* 1947, *pp* 145-147, *Vulcan Boiler and General Insurance Co, London, England.*

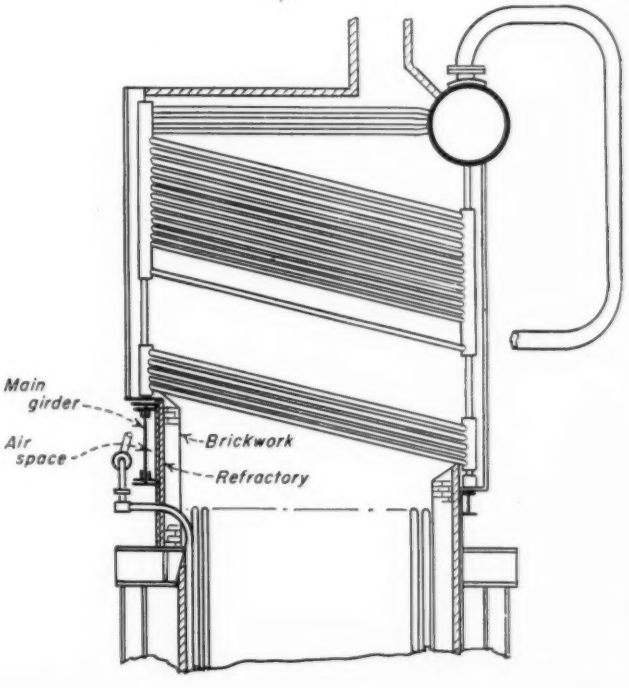
A Study of the Properties of 0.5% Chromium—0.5% Molybdenum Pipe Steel, *by R C Fitzgerald, Consolidated Gas Electric Light & Power Co; A B Wilder, National Tube Co; G V Smith, U. S. Steel Corp; and A E White, University of Michigan.* Since the occurrence, early in 1943, of severe local graphitization and failure of a welded joint of molybdenum steel in a high-pressure steam line at the Springdale Station of the West Penn Power Co, metallurgists and engineers have expended considerable effort in studying the fundamental factors involved in the reversion of carbide to graphite, and developing alloys and manufacturing practices that will inhibit the formation of graphite during commercial usage.

Of the several changes proposed to minimize or prevent graphitization, that involving the alloying addition of chromium has generally been considered the most effective. The cooperative study reported in this paper was undertaken to test this possibility. An arbitrary chromium addition of 0.5% (to the 0.5% molybdenum level commonly used for steam pipe) was selected.

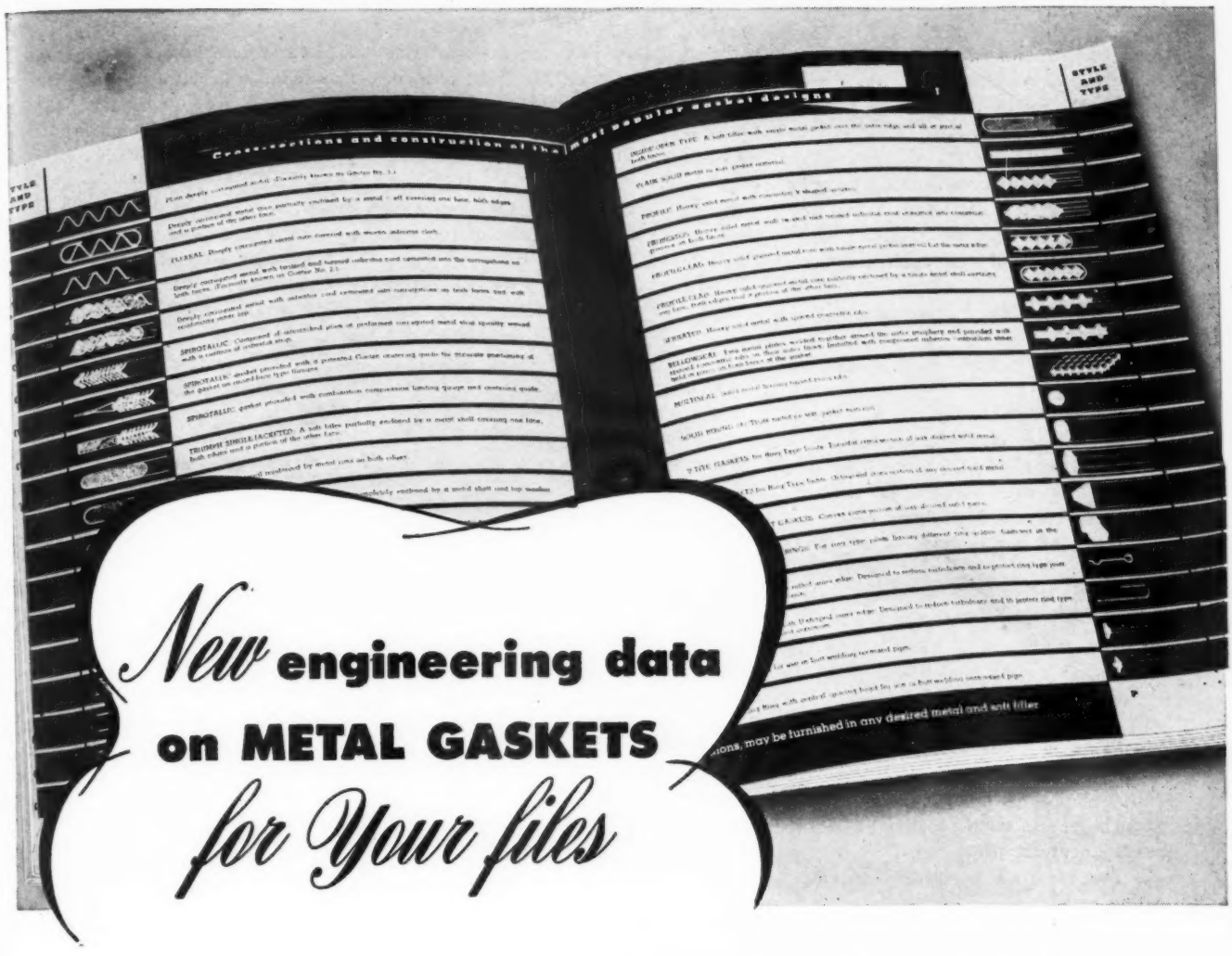
Two heats of commercial size, which cannot always be approximated by small experimental or laboratory heats, were employed for the tests. These were rolled into 10¾ in. by 1.125-in.-wall seamless pipe. The two heats were nominally identical except for the deoxidation practice employed, one being made to coarse-grained, the other to fine-grained practice. The coarse-grained



1 Built-up I-section (above) is the main girder. Corrosion reduced vertical web plate ½ to ⅛ in.; wasted stiffeners



2 Main girder (right) opens on the fire side behind a metal casing. Poor ventilation plus flue gas ate away the girder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for Your files

. . . cross-sections and construction details included in new Johns-Manville Goetze catalog

THE HANDY reference chart shown above is one of many features of the new J-M Goetze Gasket catalog which make it easier for you to select metal gaskets. It gives cross-sections and construction details of more than 30 basic Goetze Gasket designs that are available now to meet your requirements.

Here, too, you will find complete descriptions of such noteworthy developments as the Goetze Bellowseal—the gasket with the automatic self-sealing expansion joint for high temperature, high pressure service . . . the versatile Spirotallic with its combination of high mechanical strength and resilience . . . the Goetze V-Tite, a special solid metal gasket for sealing ring type joints . . . as well as the many styles of boiler, cylinder head and heat exchanger gaskets in the complete Goetze line.

In fact, there isn't an important metal gasket development which is not covered—or a single metal gasket problem to which the new J-M Goetze Gasket catalog won't help you find a practical, money-saving answer!

If you buy or use metallic gaskets, you will want to have full information about these latest Goetze developments at your finger tips. Write, on your company letterhead, for your copy of the new Goetze Gasket catalog. Address Johns-Manville, Box 290, New York 16, N. Y.

SEND FOR YOUR COPY TODAY

The new Goetze Gasket Catalog containing the handy gasket reference chart shown above has 48 pages of up-to the-minute gasket information. Write for your copy today.

JM PRODUCT

Johns-Manville *Goetze* Gaskets

heat was deoxidized with silicon only, while the fine-grained heat was deoxidized with 1¼ lb of aluminum per ton of steel in addition to a prior silicon addition.

The two steels have been extensively studied in almost all respects that are of interest in the contemplated use of the material, and the results are as follows:

1. The mechanical properties of this material at ordinary temperature are slightly higher than plain molybdenum steel.

2. Satisfactory flattening and etch tests of the pipe may be expected.

3. Welding electrodes have been developed that will satisfactorily deposit 0.5% molybdenum containing either of two levels of chromium content—0.35 and 0.5%—with properties similar to the base metal.

4. Satisfactory procedures are available for welding this material under commercial conditions. These involve preheating at 500 F as well as post heating at 1300 F.

5. Bending and upsetting tests indicate this material may be fabricated as readily as other pipe material.

6. The results of residual stress measurement are presented.

7. The material possesses adequate scaling resistance for the contemplated service range of temperature.

8. Hardness and notch-impact tests before and after exposure at elevated temperature indicate that no deleterious embrittlement may be expected during the time that this material is used.

9. No matter how the material was deoxidized, or initially or post treated, extensive studies failed to show graphitization when the metal was exposed up to 15,000 hr at 1025 F or 12,000 hr at 1100 F.

10. Creep strength of this grade of steel is comparable to some of the low chromium, low molybdenum steels.

11. In the as-rolled and stress-relieved condition, Heat X11647, to which was added 1.25 lb of aluminum per ton of steel, had the higher creep strength, while in the normalized and stress-relieved condition, Heat X11648, to which no aluminum was added, had the higher creep strength. *Presented at annual meeting, ASME; not available.*

HOW TO OBTAIN COMPLETE TEXT

Material appearing in this month's briefs comes from one of these sources:

American Society of Mechanical Engineers, annual meeting, Atlantic City, N. J., Dec 1-5, 1947. Papers are identified by initials ASME and paper No. Available while supply lasts at American Society of Mechanical Engineers, 29 W 39th St, New York 18, N. Y.

American Institute of Electrical Engineers, midwest meeting, Chicago, Ill. Nov 3-7, 1947. Papers are identified by initials AIEE and paper No. Available while supply lasts at American Institute of Electrical Engineers, 33 W 39th St, New York 18, N. Y.

SYSTEM CAPACITY

Generating Reserve Capacity Determined by the Probability Method, *by Guiseppe Calabrese, Consolidated Edison Co of N. Y.* A fundamental problem in system planning is correct determination of reserve capacity. Too low a value means excessive interruption; too high a value gives excessive costs. The problem is too complex for any rule-of-thumb solutions.

This complexity, on one side, and good engineering and sound economics, on the other, justify analysis methods permitting a systematic evaluation of all the important factors involved. Unfortunately no exact method similar to the Ohm's law for circuit problems exists for calculating reserve capacity. The probability theory can be applied for a systematic attack of the reserve problem.

Some ten years ago the author's company undertook a study to rationalize its reserve capacity program. From this study evolved a method of "judicious" application of the probability theorem. This paper describes the application of this mathematical theorem. *AIEE Paper No.* 47-248.

Outage Expectancy as a Basis for Generator Reserve, *by Howard P Seelye, Detroit Edison Co.* Three definite conceptions of the purpose of reserve generating capacity apply. They provide for (1) increase in load—particularly unexpected increases (2) outage of equipment for scheduled overhaul (3) forced outage of equipment.

The first of these should be included as a margin in load forecasts. The second is met to some extent by seasonal load variations, which permit scheduled maintenance because of the margin between load and generating capacity. The third follows equipment failure. While failure is uncontrollable, outages from this cause can be expected to follow, in general, averages indicated by past experience.

Since planning for such outages carries a heavy element of chance, the author favors the use of probability mathematics as a consistent, practical measure of "sizing up" the chances. But he strives for a method and formulas for generator outages that are (1) essentially accurate (2) simple to use even by one not familiar with probability mathematics (3) tangible conceptions, easy to grasp, of outages not in terms of decimals. *AIEE Paper No.* 47-253.

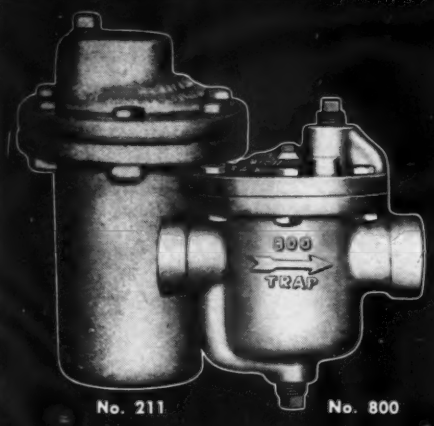
Calculating Probability of Generating Capacity Outages, *by W J Lyman, Duquesne Light Co.* A practical method for evaluating outage possibilities is valuable for (1) determining proper reserve capacity (2) analyzing effectiveness of interconnections (3) studying effect of additional generating capacity on reserve requirements.

Complex and time-consuming calculations make the use of probability mathematics a limited one. Binomial theorem works well with generating capacity units of equal size. But very few systems have generators all the same.

This paper describes the following approximate methods for (1) a short cut applicable to any number of generating units of different sizes (2) equivalent failure rates for different turbine and boiler layouts (3) a combination for different systems of two or more outage probability curves (4) effect on system-outage probability curve of adding a generating unit (5) approximation with different equipment-failure rates. *AIEE Paper No.* 47-252.

Probability Methods Applied to Generating Capacity Problems of a Combined Hydro and Steam System, *by E S Loane, C W Watchorn, Pennsylvania Water and Power Co.* The methods employed in applying probability to a specific installation are described. They are held to be good for all-steam, all-hydro or combined hydro and steam. As such these methods are valuable.

All pertinent factors are reviewed first, followed by a short description of the company's system. Then the major factors affecting the study are reviewed. *AIEE Paper No.* 47-254.



No. 211 No. 800

Above left — Armstrong bottom inlet—top outlet series trap.

Above right — Armstrong No. 800 side inlet—side outlet trap.

PROOF THAT ARMSTRONG TRAPS PAY DIVIDENDS:

50% LESS heating-up time after changeover to Armstrong Traps. — *Preston's Pure Preserves, Ltd., Ville St. Laurent, Que.*

•

50% MAINTENANCE reduction and 20% FUEL savings with use of Armstrong Traps.— *Eastern Box Company, Baltimore, Md.*

•

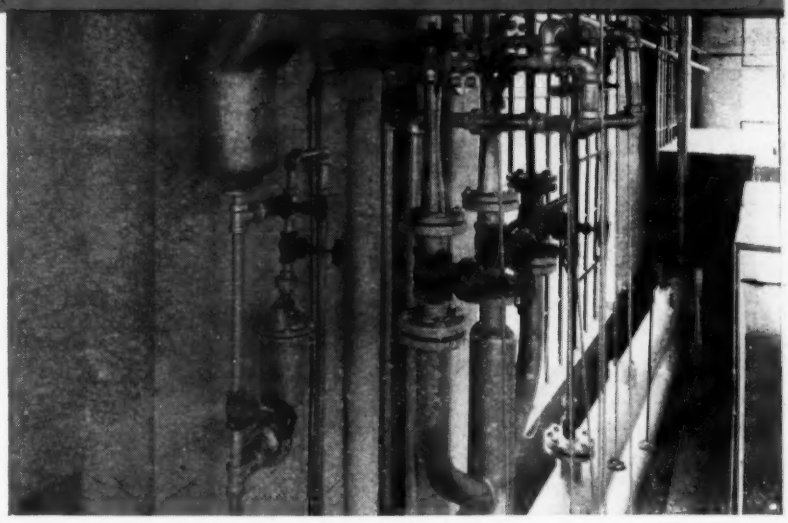
MAINTENANCE REDUCED 50% by installing Armstrong Traps.—*Defender Photo Supply Co., Rochester, N. Y.*

•

HEATING-UP TIME REDUCED 20%, FUEL CONSUMPTION 10% and MAINTENANCE COSTS 75% when manufacturer of food stuffs unit trapped 20 steam jacketed kettles with Armstrongs.—*Griggs, Cooper Co., St. Paul, Minn.*

For Fuel Savings and Maximum Production

INSTALL STEAM TRAPS CORRECTLY!



IF STEAM traps are not installed correctly they may fail to do their job — and you lose money.

For fuel savings and maximum production, check your trap installations against the following:

1. **DO YOU HAVE A TRAP ON EACH UNIT?** When you drain more than one unit with a single trap, sluggish heating and low temperatures nearly always result.
2. **ARE YOUR TRAPS LOCATED CORRECTLY?** They should be placed close to and below the unit to provide better drainage and eliminate steam binding.
3. **DO YOU NEED STRAINERS?** If there is sufficient dirt or scale in your lines to interfere with trap operation, Armstrong Y-type strainers should be installed ahead of the traps.
4. **DO YOU HAVE A BYPASS ON CRITICAL UNITS?** Traps should be installed with a bypass. The ARMSTRONG STEAM TRAP BOOK shows the correct methods of installing traps and bypasses. Send for a free copy.

ARMSTRONG MACHINE WORKS

812 Maple Street • Three Rivers, Michigan

ARMSTRONG *Inverted Bucket* STEAM TRAPS

No. 4 of a series of advertisements devoted to improving efficiency through better trapping.

POWER NEWS

BUSINESS ITEMS • APPOINTMENTS • FOREIGN FIELDS
WASHINGTON NOTES • NEW DEVELOPMENTS • CONVENTIONS

Plan to Relieve Chinese Power Shortage by 1953

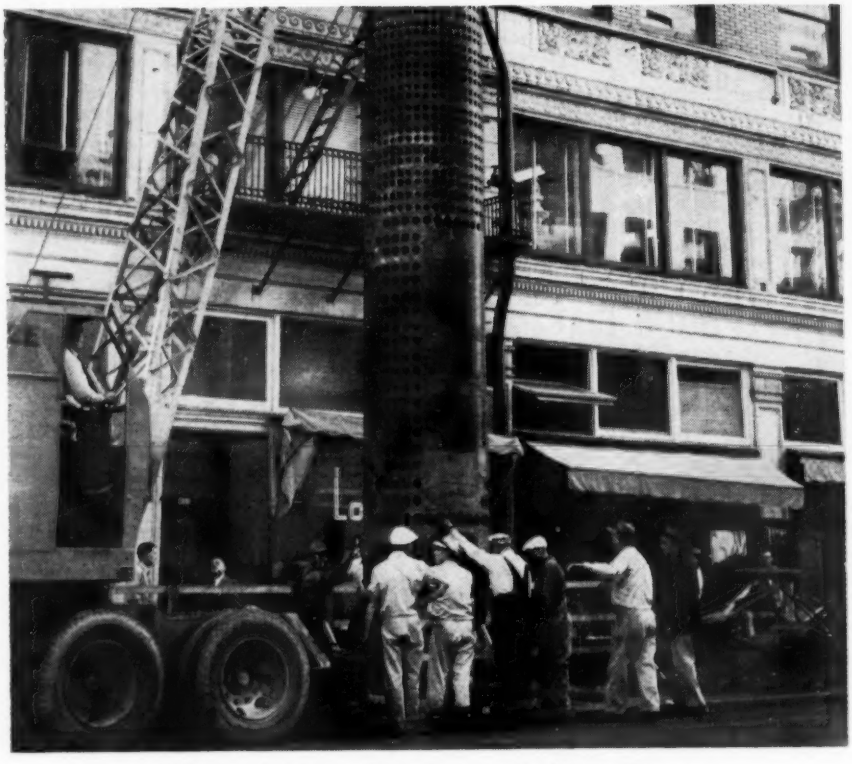
SHANGHAI: If the Chinese government approves the "United Power Plan" soon, Shanghai may have its serious electric power shortage cured by 1953. That shortage today stands at 60,000 kw—the demand load of installed manufacturing equipment that cannot be operated because generating capacity is insufficient.

The project, fathered by Paul S Hopkins, president of Shanghai Power Co, calls for the total investment of $22.2 million for installation of 100,000-kw generating capacity. The extra 40,000-kw capacity would take care of expected expansion of industry.

About $14 million will be required for purchase and transportation of plant equipment in the U. S. The remainder covers Chinese currency expenditures within China for construction and labor.

If and when the franchise is approved, it is proposed to seek a dollar loan from the U. S. government of $14 million. Bonds of the United Power Co will be delivered against loan advances. These bonds are to command all profits from the company until the amortization is complete.

(*Continued on page* 158)



Boiler Steam Drum on Its Way Down

Suspended from a crane boom and guided by riggers, this 4-ft-dia steam drum, 30 ft long and weighing 11 tons, is being lowered through a street opening into Pacific Power & Light Company's Pittock Station, located in the basement of an office building in Portland's business area. The new 150,000-lb-per-hr B & W boiler, of which the drum is a part, will increase capacity of the central-heating system by about 25%

COMING EVENTS

Mar 1-4—American Society of Mechanical Engineers, spring meeting, St. Charles Hotel, New Orleans, La. Ernest Hartford, executive assistant secretary, 29 W 39th St, New York.

Mar 9-11—Western Pa. Safety Engrg Conference & Exhibit, Hotel William Penn, Pittsburgh, Pa. Harry H Brainerd, executive manager, Chamber of Commerce Bldg, Pittsburgh.

Apr 1-3—American Institute of Electrical Engineers, Great Lakes district meeting, Des Moines, Iowa. H H Henline, secretary, 33 W 39th St, New York 18, N. Y.

Apr 3-11 New England Electrical Show, Mechanics Bldg, Boston, Mass. Campbell-Fairbanks Exposition, Inc, 929 Park Sq Bldg, Boston, Mass.

Apr 5-8—National Assn of Corrosion Engineers, Hotel Jefferson, St. Louis, Mo. A B Campbell, executive secretary, 905 Southern Standard Bldg, Houston 2, Tex.

Apr 5-8—National Oil Heat Exposition, Chicago Coliseum, Chicago, Ill. C F Curtin, secretary-treasurer, Room 1837, 30 Rockefeller Pl, New York 20.

Apr 7-9—Midwest Power Conference, Sheraton Hotel, Chicago, Ill. Stanton E Winston, director of MPC, Illinois Institute of Technology, 3300 S Federal St, Chicago 16, Ill.

Apr 28-30—American Institute of Electrical Engineers, Northeastern district meeting, New Haven, Conn. H H Henline, secretary, 33 W 39th St, New York 18, N. Y.

May 6-7—Sixth Annual Anthracite Conference, Anthracite Institute and Lehigh University, held at Lehigh University, Bethlehem, Pa. A Copeland Callen, dept of mining engrg, Lehigh University, Bethlehem, Pa.

May 11-16—Engineers' Club of Philadelphia, junior members, engineering progress show, Franklin Hall in Franklin Institute of Pa., 1317 Spruce St, Philadelphia 7, Pa. Joseph J Quinn Jr, chairman, 1317 Spruce St, Philadelphia 7, Pa.

May 30-June 5—American Society of Mechanical Engineers, semiannual meeting, Schroeder Hotel, Milwaukee, Wis. Ernest Hartford, executive assistant secretary, 29 W 39th St, New York 18, N. Y.

Complete Boiler Plant for Large Strip Mill | Boilers and Firing Equipment in Strip Mill Boiler Plant | Turbogenerators in Plant of Eastern Food Producer | Boiler and Compressor Plant for Automotive Manufacturer

POWER
FOR ALL INDUSTRY

Addition to High Pressure Boiler Plant for Steel Producer | Power Plant Construction at Large Midwestern Petroleum Refinery | Boiler Plant for Federal Government Facility | Boiler Plant Addition for Chemical Processor

THROUGHOUT the field of industrial building the complete coordination of separate elements is never more important than in boiler and power plant construction. Many types of equipment and many specialized building operations must be fitted into the pattern specified by the consulting engineer.

Here, in the construction of power and boiler plants, the skill of the builder can be the most important ingredient of efficient and successful operation. Here, the specialists in power and boiler plant construction can be of greatest service to all industry.

Dravo Corporation builds complete power plants. Typical examples of Dravo-built power and boiler plants can be found in steel mills, food processing plants, oil refineries, Federal and Municipal institutions, automotive manufacturers, chemical processors. Many of these installations were built by Dravo under contracts which involved total responsibility for building and installation of equipment; other projects included installation of major items of equipment.

Dravo Power Plant Specialists can be of real service in carrying out your plans. Wherever you need boiler or power plant construction or modernization—Call Dravo.

Bulletin GN 504 describes, in detail, how DRAVO power and boiler plant construction experience will serve you.

DRAVO CORPORATION

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Power and Boiler Plants — Pumping Stations — Power Plant and Contractor's Equipment — Direct-Fired Heaters — Industrial Heating and Ventilating
Bridge Substructures — Docks — Pump Houses and Intakes — Mill Foundations — Locks and Dams — Shafts, Slopes and Tunnels — Towboats and Barges
Coal and Ore Bridges — Cranes and Derrick Boats — Crane Cab Coolers — Open Steel Flooring — Concrete Aggregates — Inland River Transportation

Wealth Is a Flow, Not a Fund

I saw a dramatic illustration in the Middle West a few weeks ago of the economic maxim that "wealth is a flow, not a fund." Successful businesses and operations are built by men with dynamic instincts for the flow of things. Decline begins when control is taken over by men whose instincts are for hoarding and preserving the funds. This stops the flow, and the wealth starts to seep away.

Two plants in the same city produce similar lines of equipment, and both have been in business about the same number of years. Plant A is run by a second-generation owner—a dynamic engineer. His establishment is a model that brings appreciative amazement from senior engineering students at the nearby state university, on their annual inspection trips. It possesses all the most up-to-date production tools, the power department prides itself on being the most efficient in that area, maintenance is a masterpiece of housekeeping—everything is shipshape and modern.

At Plant B, the manager is responsible to several families of stockholders, who are far too close by. They have charged him with the duty of preserving profits at the highest possible level—and his efforts to be a good counting-house custodian have induced neglect in other departments. Results: a rather shabby looking production floor, outmoded boilers and turbines that are costing the owners money every day, second-rate maintenance—the general appearance of a place where no investment is being made to keep the plant in step with modern methods and equipment.

In B's case, wealth hasn't yet started to seep away, but reputation and standing in the field have. Some years ago, products made by Plant B were regarded as the leading brands by the buyers; today, B ranks third and A has moved into No. 1 spot. Here is the first sign of decay—the other phases will soon become obvious.

Power engineers should never let themselves be forced into becoming "guardians of the funds"—power engineering is too dynamic a force, too great an implement of progress. If you run a power system in a plant managed by a "counting-house custodian," you've got to start campaigning for a change in his attitude toward your department.

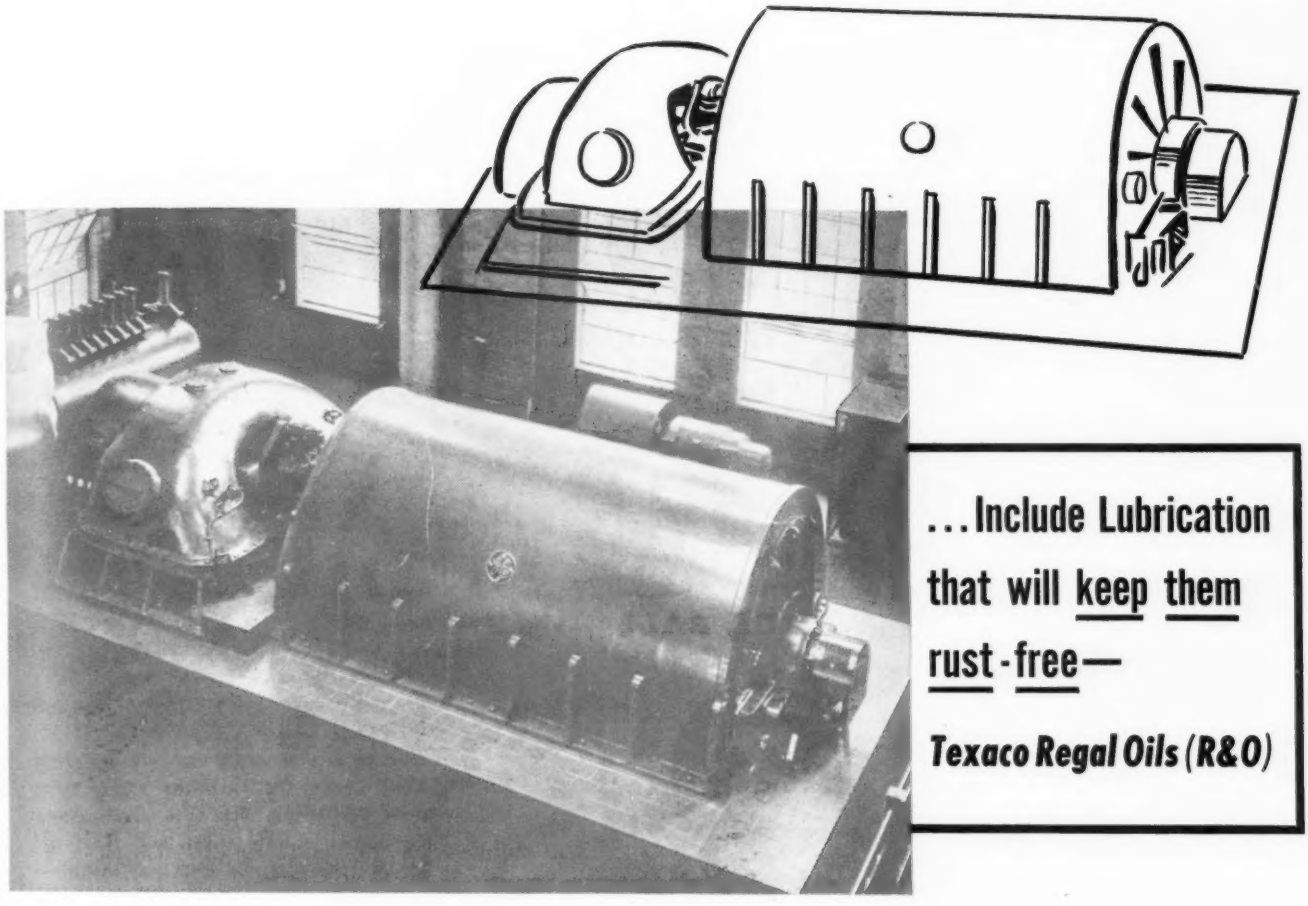
This means collecting case histories from your engineering magazines and your associates of plants where programs of continued improvement over the years have paid off. This means plenty of facts on dollars and cents to be saved with new equipment and methods (on which you can enlist the help of salesmen who call on you), which you can use in a series of memorandums to the plant manager. It means a careful analysis of waste, leaks and dribbles in order to reveal inexpensive ways to save—maybe if you can come up with ways to save several hundreds of dollars, he will let you try to save several thousands.

The same goes for our own personal income: We will never see it seep away if we keep alive our instinct for the flow of things.

George Edwards

Engineer

In Your Plans for New Turbines



...Include Lubrication that will keep them rust-free—

Texaco Regal Oils (R&O)

YOU can't keep moisture out of your turbine lubricating systems, but you *can* prevent it from forming rust. When a new turbine, for example, is charged with *Texaco Regal Oil* (*R & O*), a special rust inhibitor immediately "plates out" on the metal. Thereafter, no moisture can reach the metal. Rust gets no chance to form.

Rust prevention is only one of many benefits you get with *Texaco Regal Oils* (*R & O*)—the world-famous Texaco Regal Oils *improved* with inhibitors against oxidation as well as rust, and specially processed to prevent foaming. *Texaco Regal Oils* (*R & O*) assure clean lubricating systems in both new and old turbines . . . freedom from rust, sludge and foam . . . normal bearing temperatures . . . instant governor response . . . and extra long oil service life.

Texaco Regal Oils (*R & O*) are approved by all leading turbine manufacturers and meet the turbine oil requirements of the United States Navy.

Let a Texaco Lubrication Engineer tell you about the complete line of Texaco Lubricants for every power plant requirement. Just call the nearest of the more than 2500 Texaco Distributing Plants in the 48 States, or write The Texas Company, 135 East 42nd Street, New York 17, N. Y.

TEXACO

TEXACO Regal Oils (R&O)

FOR ALL TURBINES

TUNE IN . . . TEXACO STAR THEATRE presents the TONY MARTIN SHOW every Wednesday night. • METROPOLITAN OPERA broadcasts every Saturday afternoon.

4 Good Reasons for Specifying DART UNIONS

1 **TWO BRONZE SEATS**
(Non-corroding)

2 **TRUE BALL JOINT**
(Leak-proof)

3 **EXTRA-HEAVY SHOULDERS**
(Withstand abuse)

4 **MALLEABLE IRON BODY**
(Practically indestructible)

THESE Dart advantages all spell *longer life.* Because of the two precision-ground bronze seats, Darts are non-corroding on *both* sides of the true ball joint, making a drop-tight leak-proof connection. They open and close *easily* without excessive wrenching, and can be reused over and over. Body and nut are made of high-test, air-refined malleable iron—practically indestructible.

Ask your supplier to demonstrate these advantages.

DART UNIONS

E. M. DART MFG. CO.
PROVIDENCE 5, RHODE ISLAND

Adjustable Vanes

(*Continued from page* 93)

as the amount of water pumped through them. Therefore, it is desirable to hold this quantity at the economical minimum.

Head-capacity characteristics of these pumps are such that power input decreases at shutoff at reduced vane angles, permitting the pump to be started against closed discharge. For example, at a 6-deg vane angle and closed discharge, power increases to only about 180 hp, point *H*, and the head to 75 ft, point *J*. This power is well within the capacity of the 200-hp motor driving the pump.

Where impeller-vane angle does not have to be controlled from a remote point, it may be done by a handwheel and screw similar to a gate valve. This arrangement considerably reduces the cost for the vane-adjusting equipment. When the pump can be stopped for a few minutes to adjust vane angle, all external linkage and control can be eliminated. In one design, the adjusting shaft is locked in the suction bell, and the rotating element moved up or down by an adjusting nut on the motor's top. This is similar to the method used to adjust minimum running clearance in vertical turbine pumps with open impellers. In this arrangement the impeller hub is the only part different from the conventional axial-flow pump that is equipped with fixed impeller vanes.

TWO-STAGE PUMPS

To extend the head range of axial-flow pumps 2-stage units can be built. Even though mechanical assemblies become more complicated, advantages increase in proportion to head. Two-stage axial-flow pumps with adjustable vanes for 65-ft total head have been built abroad. Design of the pump here described lends itself to 2-stage construction. Only the hub assemblies would be duplicated because the same external lever system and vane-operating mechanism would be used for both impellers.

Power saving is not always the main reason for installing adjustable-vane axial-flow pumps. A number of services, such as irrigation, drainage, storm-water, sewage and dry-dock pumping, require maximum capacity at any head within the limits of the power-unit capacity. In such applications power saving is only a secondary consideration in the selection of the pump.

FAIRFIELD
coal handling system

One of the most efficient and dependable methods of handling coal is the Fairfield skip hoist.

Shown is a 60 cu. ft. skip hoist with a 91 ft. lift, elevating the coal to hoppered bottom coal bunkers inside the plant. The system has a capacity of 50 tons per hour.

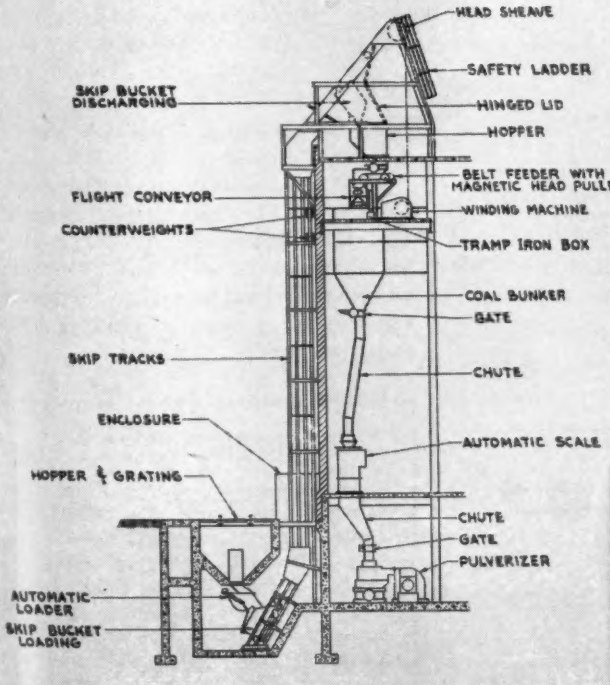
At the skip discharge the coal is passed over a magnetic belt feeder which removes tramp iron. The coal is then distributed to the bunkers by a double strand roller flight conveyor. It is then weighed as used and delivered to the pulverizers.

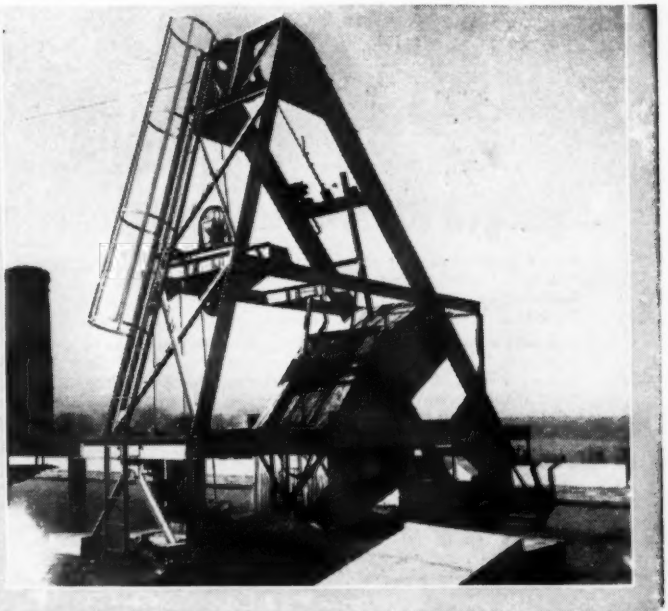
This installation was designed—built—erected by Fairfield to meet the specific needs of this plant.

Fairfield Engineers will gladly do the same kind of a job for you. Why not write us for complete details today.

Above—Illustrating skip hoist on outside wall of power plant.

Right—Shows skip hoist superstructure on roof of power plant.





THE FAIRFIELD ENGINEERING CO.

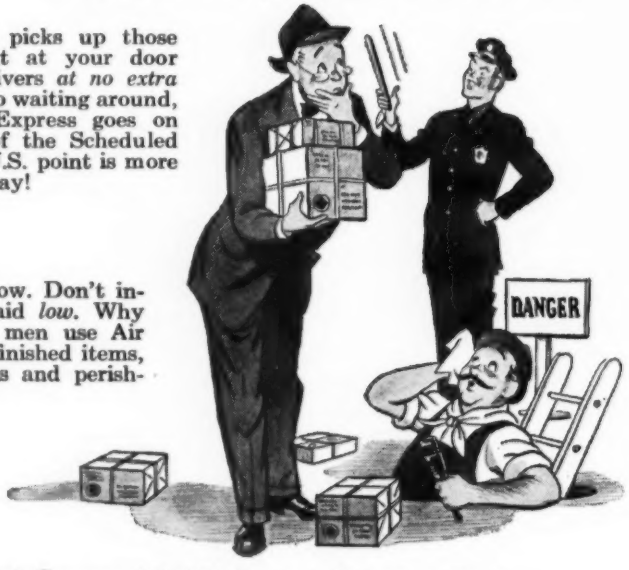
Builders of Coal and Ash Handling Equipment

320 CHICAGO AVENUE · · MARION, OHIO

"Hold it, bub!"

"No jay-walkin' here! Gotta get to the airport? To Air Express those packages? My poor friend — haven't you heard?

"Air Express picks up those packages right at your door here, and delivers *at no extra cost.* There's no waiting around, because Air Express goes on every flight of the Scheduled Airlines. No U.S. point is more than hours away!



"And rates are low. Don't interrupt me—I said *low.* Why else do business men use Air Express to ship finished items, replacement parts and perishables *regularly?*"

Specify Air Express-World's Fastest Shipping Service

- Low rates—special pick-up and delivery in principal U.S. towns and cities at no extra cost.
- Moves on all flights of all Scheduled Airlines.
- Air-rail between 22,000 off-airline offices.

True case history: Machine parts made in Camden were needed in Chicago in a rush. 32-lb. package picked up the 28th at 10 A.M., delivered same day at 5 P.M. 669 miles, Air Express charge only $6.88. Gave days more time to complete the job. Other weights, any distance, similarly inexpensive and *fast.* Just phone your local Air Express Division, Railway Express Agency, for fast shipping action.

AIR EXPRESS

AIR EXPRESS — GETS THERE FIRST

Rates include pick-up and delivery door to door in all principal towns and cities

AIR EXPRESS, A SERVICE OF RAILWAY EXPRESS AGENCY AND THE

SCHEDULED AIRLINES OF THE U.S.

Pump Q and A

(*Continued from page* 105)

atmosphere. An attempt to remove the pump under these conditions usually wedges the material farther between the bowls and casing.

Sometimes, a pump can be freed. At other times, the well casing must be removed with the pump, but often removal is impossible and the only alternative is to drill a new well. A 10-in. pump with a 9½-in. outside diameter would probably prove satisfactory in the 12-in. casing described above.

Q 7—What are the possible effects on a deepwell pump of excessive sand in the well water?

A—These include: (1) Bearing, impellers and internal pump parts wear rapidly. (2) Power input is high and pumping capacity decreases because of wear. (3) Clearance areas in bowls may become clogged with sand. When the latter occurs a pump is said to be sand locked.

Q 8—What causes excessive sand in well water?

A—Among the causes are: (1) insufficient development of well before pump installation (2) lack of adequate well screening (3) perforated casing.

Q 9—What are the causes of a deepwell collapsing?

A—They are: (1) Well casing deteriorates. (2) Water-bearing strata cave in. (3) An earthquake occurs.

Q 10—What are the possible effects of a collapsed well?

A—When a well collapses it may bend or break the pump column or bowls, or lock the pump in the well.

Q 11—What causes insufficient water in a well?

A—Of the several causes the most likely are: (1) well screen clogged (2) water strata clogged (3) strata breakdown or caved in and (4) over pumping of water table. Without enough water, a pump may operate dry, and wear rapidly.

MODERN DIESELS

Commemorating the 50th anniversary of the American diesel, POWER's April issue will carry a 32-page special section surveying modern practice in this field. It will cover basic principles, construction details, intake and exhaust, injection, combustion, and engine applications. Watch for it!

Edge Moor Radiant Heat Boiler equipped with Edge Moor vertical tube integral economizer. Fired with continuous discharge spreader stoker. 150,000 lbs. steam per hour, 500 lbs. pressure, 750° F. total steam temperature.

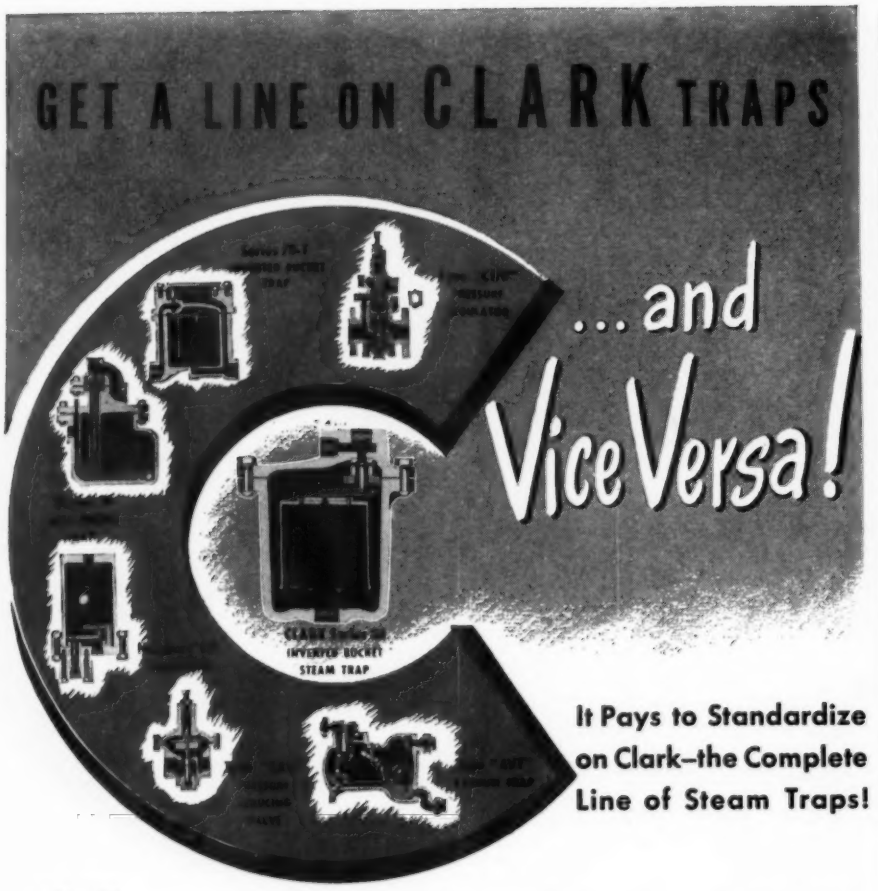
BOILERS *by* edge moor

THE dependability, efficiency and flexibility of this unit has been made possible by 80 years of Edge Moor designing and engineering skill. Its design provides for a large water storage, generous steam liberation surface and quiet offtake drum. Maximum boiler tube surface is exposed to radiant heat and furnace cooling is arranged for a minimum of maintenance. This quick-steaming unit delivers continuous high ratings over many years and is adaptable to all fuels.

This and other types of Edge Moor boilers are available in a wide range of capacities, pressures and accessory equipment. Write for literature today. EDGE MOOR IRON WORKS, INC. Main Office and Works: Edge Moor, Delaware. Branch Offices and Agents: Atlanta, Boston, Chicago, Detroit, Hoboken, St. Paul, San Antonio and San Francisco.

edge moor steam generating equipment

EM



It Pays to Standardize on Clark–the Complete Line of Steam Traps!

40 YEARS OF EXPERIENCE PROVE THAT CLARK CONTROLS

Last Longer
Cut Maintenance Costs
Reduce Fuel Bills

If your production costs have been going up (and whose haven't) Clark can help you "hold the price line." The Heavier, Stronger construction of CLARK Controls makes for longer life and less frequent replacement. Our Engineering Department stands ready to help you on all fluid control problems.

Write today for details.

Write today for this free, helpful guide to more economical controls for your oil, steam and air lines.

THE CLARK MANUFACTURING CO.
1831 East 38th Street • Cleveland 14, Ohio

Clark
FLUID CONTROLS

Engineer's Bookshelf

(*Continued from page* 116)

briefs of the theories concerning many processes. Chapters include: thermodynamic data, piping, hydraulic, flow measurements, heat transfer, combustion, power, pumps, fans, blowers, compressors, absorption, stripping, distillation, water.

INDUSTRIAL MANAGEMENT (*4th edition*-1947) *By William R Spriegel, Northwestern University.* 656 *pp*, 6x9, *illust, cloth.* $5. *John Wiley & Sons, Inc,* 440 *Fourth Ave, New York* 16, *N. Y.*

Originally written by Prof R H Lansburgh, this standard work on industrial management has been completely revised by Prof Spriegel and a new chapter on maintenance added. As in past editions, all phases of the subject are covered: plant location, organization, plant layout and equipment, motion and time study, wages, buying, selling and transportation, material and production control, personnel administration.

To an ever greater extent, the power engineer in industry must be familiar with management policies and problems if he is to discharge his responsibilities with full effectiveness. This text should prove of value in bringing him up-to-date on recent developments in this field.

INDUSTRIAL APPLICATIONS OF INFRARED (1947). *By James Doyle Hall, advisory engineer, lamp division, Westinghouse Electric Corp.* 201 *pp.* 9½x6½, *cloth.* $3.50. *McGraw-Hill Book Co,* 330 *W* 42*nd St, New York* 18, *N. Y.*

There has been widespread and ever-increasing interest in infrared radiation for an almost endless number and variety of heat applications. This book provides a nontechnical source of reference which anticipates and answers many of the questions on the subject.

Simple test procedures are outlined, and data from several sources are used. A variety of infrared installations, photographically recorded, should be of assistance in solving problems and suggesting additional uses of radiant heat.

FLUID MECHANICS OF TURBOMACHINERY (1947). *By George F Wislicenus, compressor research engineer.* 613 *pp;* 5½x8; *charts,* 258 *illust;* $7.50. *McGraw-Hill Book Co,* 330 *West* 42*nd St, New York* 18, *N. Y.*

While this book cannot be considered an elementary introduction to general fluid mechanics, it does contain an explanation of those principles applying to this field in an endeavor to make this book self-contained. The geometry of hydrodynamic machines is introduced here as a new subject. It has been separated clearly from the hydraulic consideration of the design problem. This distinction agrees with the present state of the theory of turbomachinery, which doesn't permit, for in-

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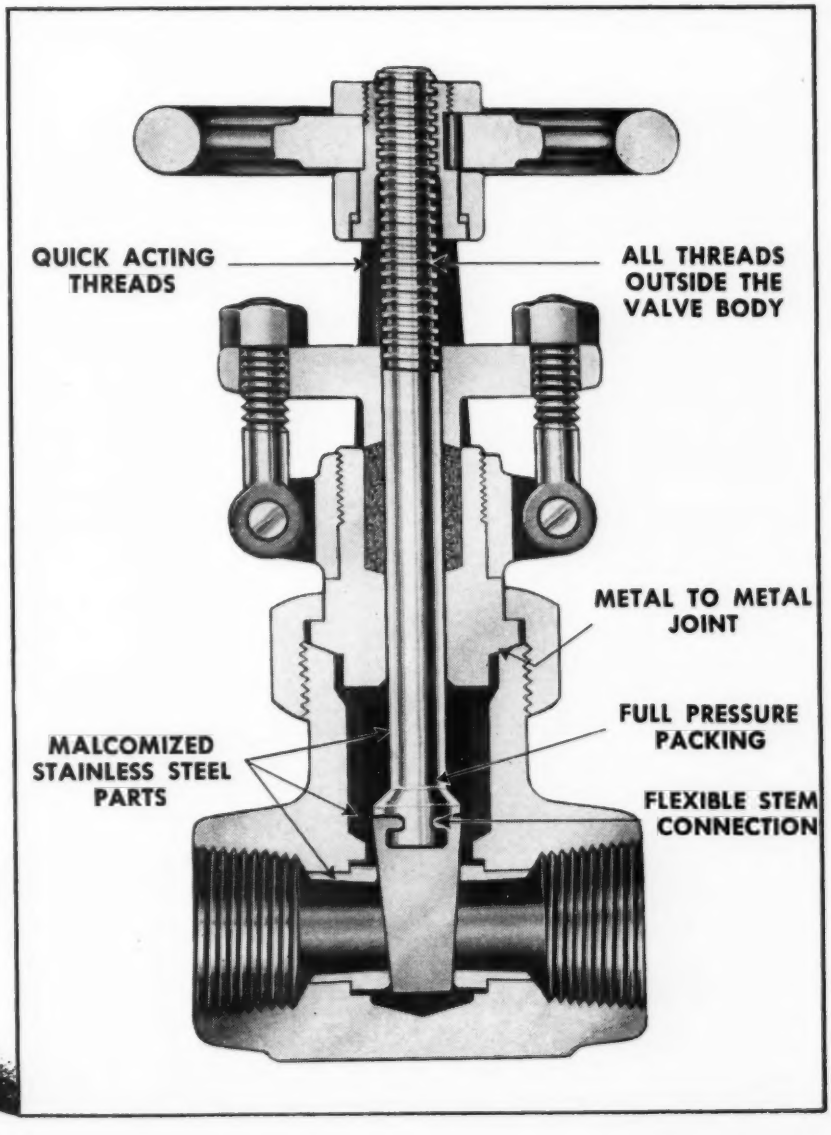

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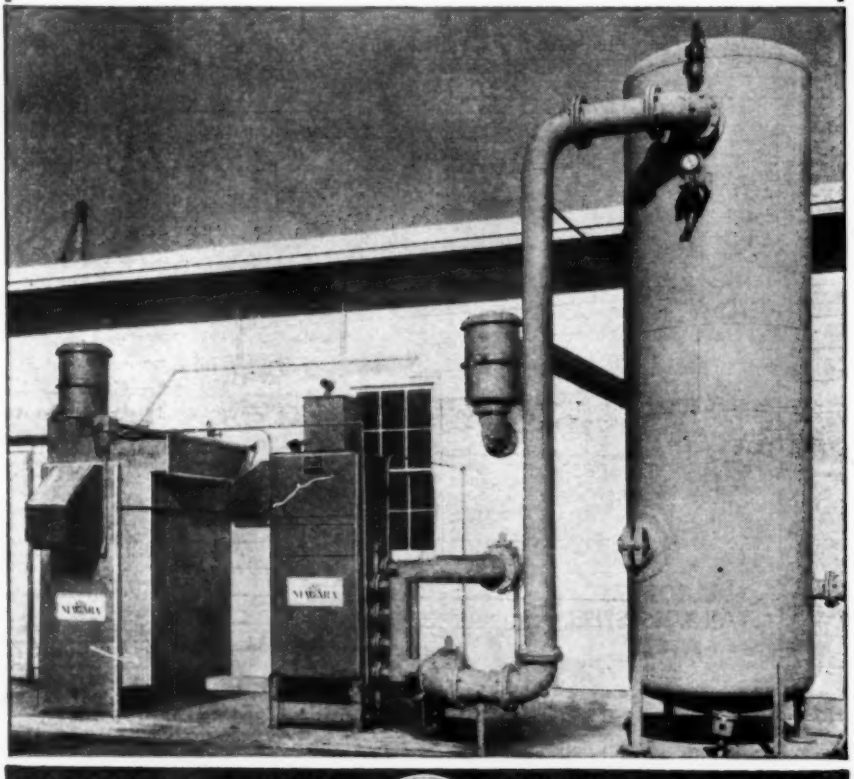

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stance, determining the exact vane shape of a pump or turbine runner on the basis of pure hydraulic investigations. On the other hand, such vane shapes are regularly developed by means of geometric considerations, which are the key to the difference between theoretical and practical methods.

This book is suitable for senior and graduate engineering students, as well as engineers who are engaged in design or research on turbomachinery.

PRACTICAL ELECTRICAL WIRING (1947). *By H P Richter, 574 pp, 5½x8¼, cloth. $3.75. McGraw-Hill Book Co, 330 W 42nd St, New York 18, N. Y.*

Simple enough for the beginner this book is also complete enough for experienced electricians. The contents are presented in such a way that the reader may learn both the how and why. This method helps the student solve problems that arise in practice.

Written in three parts that deal with: fundamentals, terminology, basic principles and practical theory (2) wiring of houses and farms (3) actual wiring of stores, factories, schools and similar structures.

Electricians and apprentices will find this book useful.

HANDBOOK ON HYDRAULIC OILS (1947) *48 pp, illust, paper, free. E F Houghton & Co, 303 W Lehigh Ave, Philadelphia 33, Pa.*

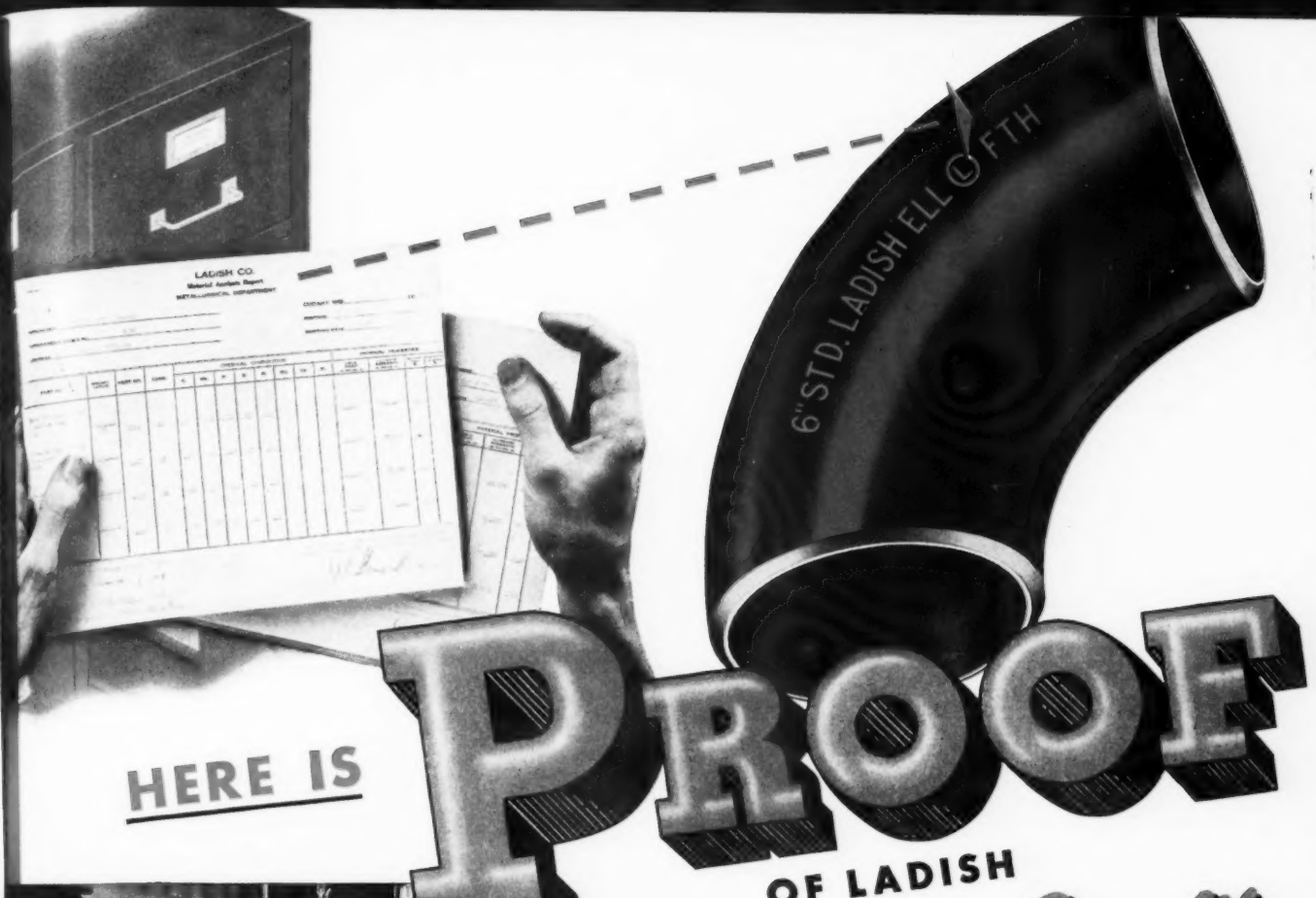
Divided into six chapters, this booklet deals with hydraulic-oil specifications—their value and weakness; importance of properties not in specifications; additive treatment of hydraulic oils; trouble shooting; qualities that a good oil must possess; and hydro-drive hydraulic oils. It is written in a simple, practical style that mechanics readily understand.

STANDARD WELDING SYMBOLS AND RULES FOR THEIR USE. *67 pp, 5¾x9, numerous illust, paper, $.50. American Welding Society, 33 W 39th St, New York 18, N. Y.*

In establishing the 1947 Standard Welding Symbols the committee on symbols carefully considered the needs of users of welding equipment and adopted rules that provide for the needs of management, designers and shop men. The rules have been expanded to cover all types of welding and clarify confusing nomenclature. Clear-cut illustrations explain how the symbols are applied.

COLLOID SCIENCE (1947). *A symposium by E K Rideal, A E Alexander, D D Eley, P Johnson, F Eirich, R F Tucket, J H Schulman, M P Perutz, G S Adair, G B B M Sutherland and R R Smith. 208 pp, 5½x8½, cloth, $6. Chemical Publishing Co, Inc, Brooklyn, N. Y.*

This highly technical text is a symposium taken from a course of lectures in colloid science at Cambridge University, Cambridge, England, under the auspices of the Royal Institute of Chemistry. It discusses such subjects as surface chemistry



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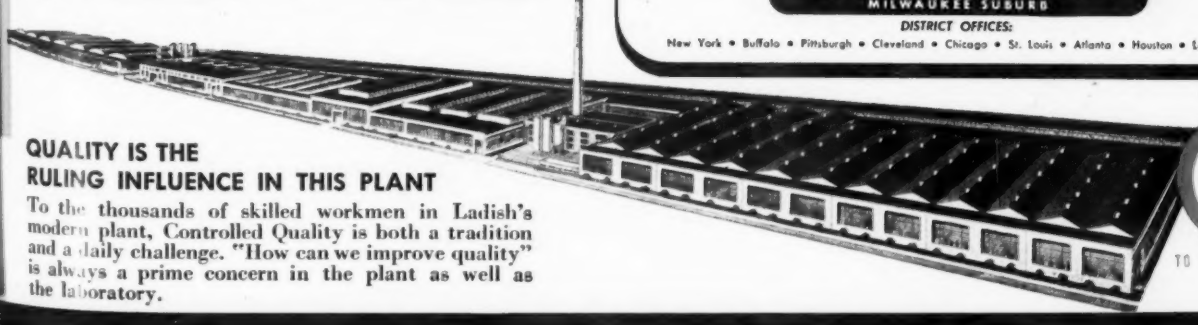

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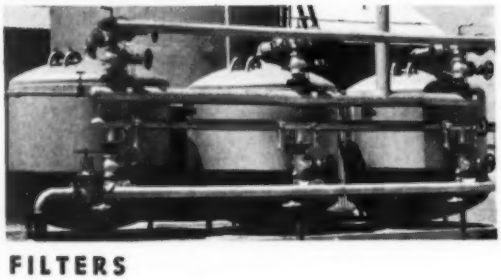
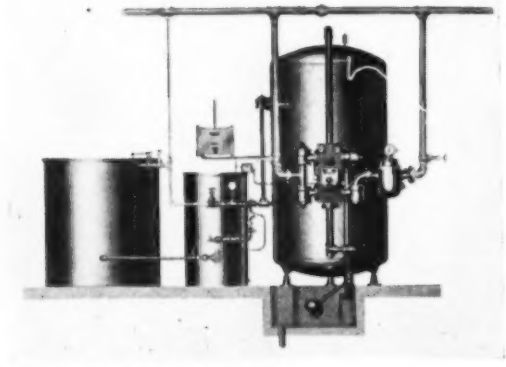
HOT-FLOW*

ACCELATOR*



FILTERS



ION EXCHANGER

Maybe the four kinds of water listed do not exactly describe your water supply, but—

No matter what kind of water you must use, it is more than likely that it is not entirely satisfactory for boiler feed, process use, cooling system makeup, etc.

Maybe you have a water treating plant, but is it economical and efficient, as measured by current standards?

Various types of INFILCO equipment pictured here—separately or in suitable combinations—will "tailor" your water to your needs.

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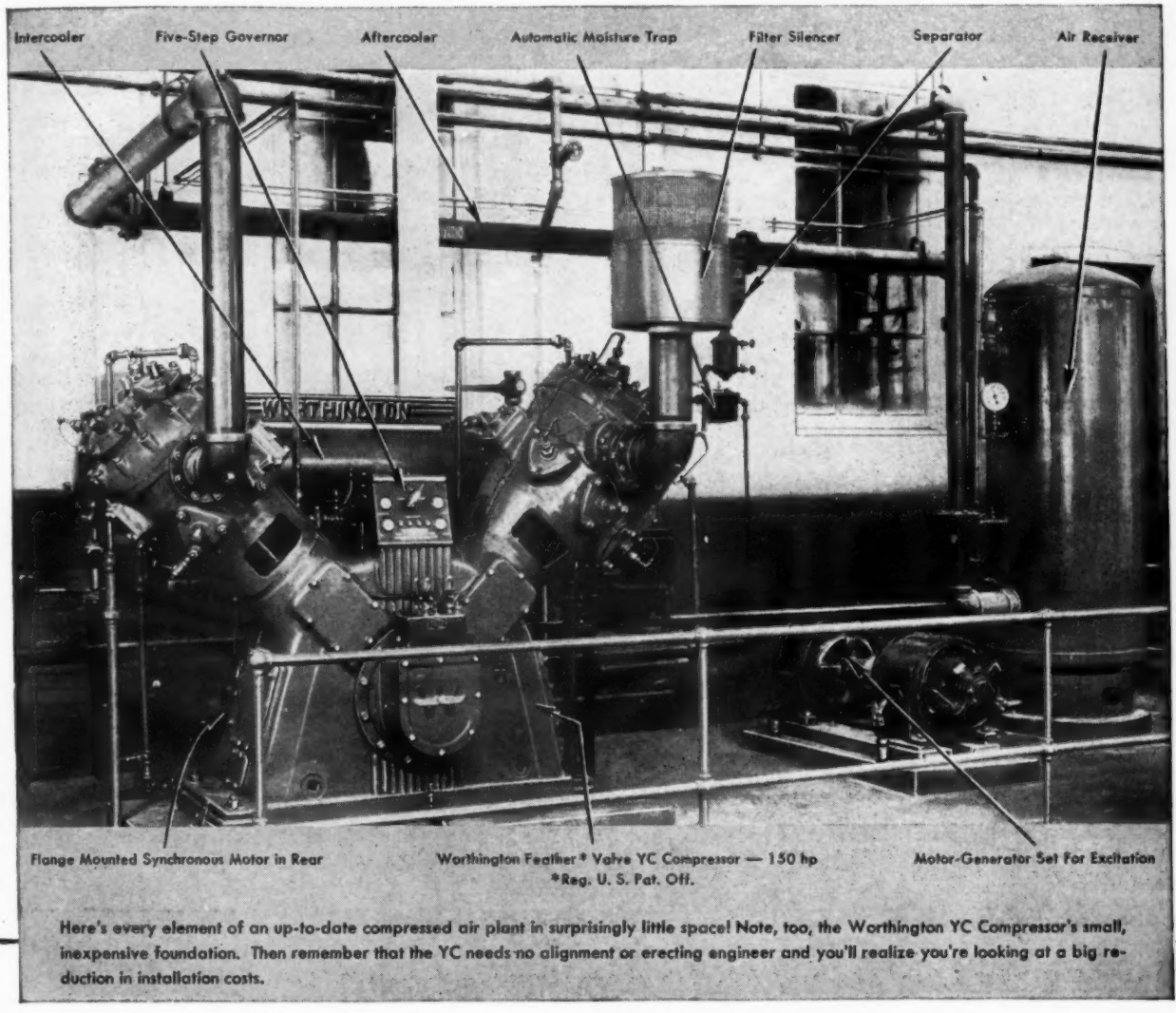

Here's every element of an up-to-date compressed air plant in surprisingly little space! Note, too, the Worthington YC Compressor's small, inexpensive foundation. Then remember that the YC needs no alignment or erecting engineer and you'll realize you're looking at a big reduction in installation costs.

Plus HIDDEN Advantages Like These:

Power factor improvement from the synchronous motor and quick-acting, 5-step governor . . . completely automatic control for the entire system, as in the largest compressed air plants . . . advanced YC design that assures a longer-lived, cooler and smoother running compressor, with maintenance and operating expenses at their lowest.

Write for further facts that prove *there's more worth in Worthington.* Bulletin L-667-B1A tells the complete story of how YC Compressors can cut your air costs. *Worthington Pump and Machinery Corporation, Compressor Division, Buffalo, New York.*

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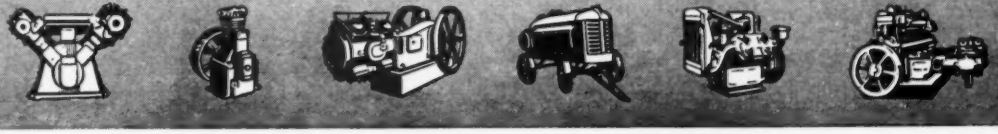
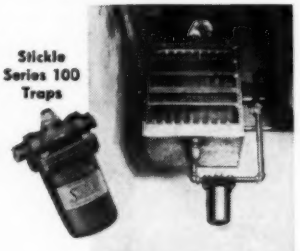
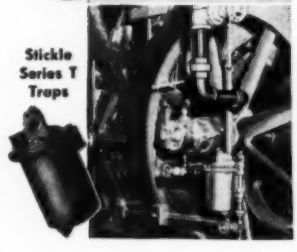


Full OPERATING ECONOMY

Positive Drainage of Processing Units . . . Increased Boiler Capacity and More Uniform Operating Pressures . . . Greatly Reduced Fuel Consumption . . . PLUS Other Operating and Maintenance Savings

Stickle Drainage for steam processing equipment provides for completely efficient unit performance. Stickle Traps allow heating spaces to be filled continuously with live steam. Condensate is removed as rapidly as it accumulates. Air is eliminated with condensate. Stickle Open Float principle supplies positive trap operation, and provides construction simplicity that frees traps of mechanical difficulties. Made in series designs for various drainage applications and specific conditions of operation.



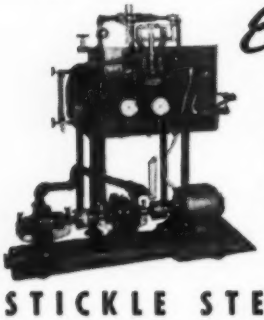


STICKLE SERIES 100 TRAPS, designed for straight-in-line installation, meet the requirements of all types of smaller equipment operating at medium to high pressures. Capacity range, 250 to 5,000 lbs. per hour. Described in Bulletin No. 115.

STICKLE SERIES AE TRAPS have four times the capacity of standard traps and handle drainage for a wide range of industrial processing, with equipment operating at medium to high pressures. Capacity range, 5,000 to 40,000 lbs. per hour. See Bulletin No. 315 for data.

STICKLE SERIES 50 TRAPS are specifically designed to handle condensate from processing units operating at high pressures having variable conditions of pressure and variable rates of condensation, such as submerged coils in large open tanks. Capacity, eight times that of standard traps, with capacity range of 18,000 to 46,000 lbs. per hour. Ask for Bulletin No. 515.

STICKLE SERIES T TRAPS have a wide range of application for draining units operating at medium and low pressures and on vacuum. The series includes radiator traps, small to large utility traps, and traps of extra large capacities. Bulletin No. 415 supplies complete information.



Eliminate Waste OF BTUs

Unit trapping of equipment combined with Stickle Differential Drainage and Boiler Return System permits all condensate to be returned directly to boilers at a temperature only a few degrees lower than steam at operating pressure. This represents 85 per cent, or more of boiler supply. Fuel saving, on average installation, about 15 per cent, with a like ratio of increase in boiler capacity. Working pressures more uniform; flash steam waste eliminated; and pumping costs and boiler and steam line maintenance reduced. Ask for Bulletin No. 250.

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STICKLE EQUIPMENT

STICKLE DIFFERENTIAL AND BOILER RETURN SYSTEMS • STICKLE OPEN FLOAT STEAM TRAPS • STICKLE REGULATING AND REDUCING VALVES • STICKLE OPEN COIL FEED WATER HEATERS AND PURIFIERS • STICKLE OIL AND STEAM SEPARATORS STICKLE TEMPERATURE CONTROLLERS AND OTHER SPECIALTIES

and colloids; thermodynamics and colloidal systems; the study of macromolecules by ultracentrifuge, electrophoresis and diffusion measurement; kinetic theory of high elasticity.

ENGINEERING DATA BOOK, *by Arthur G Vogel, 34 pp, 8½x11, illust, paper, $1.50. Rempe Co, 340 N Sacramento Blvd, Chicago 12, Ill.*

Here is a guide for the engineer and draftsman in the design of pipe and fin coils, with specific data on the subjects of dimensional limitations, coil-development formulas and heat-transfer factors.

AIR CONDITIONING (1947). *By Herbert Herkimer, consulting and industrial engineer, past director, Herkimer Institute of Mechanical Trades and Harold Herkimer, design engineer and project manager, Raisler Corp. 692 pp, 5½x8½, illust, tables and charts, cloth $12. Chemical Publishing Co Inc, Brooklyn, N. Y.*

First part of the book reviews the laws of chemistry and physics associated with the science of air conditioning. Second part deals with the practical side, that is equipment, material and costs. The book is based, says the author, on a collection of notes and personally prepared formulas, accumulated over a 35-year period of experience in the air-conditioning field.

HOW TO RUN A LATHE (45th *edition*) 128 *pp, 5x8, 365 illust, paper $0.25. Leatherette cover, $1. South Bend Lathe Works, 459 E Madison St, South Bend 22, Ind.*

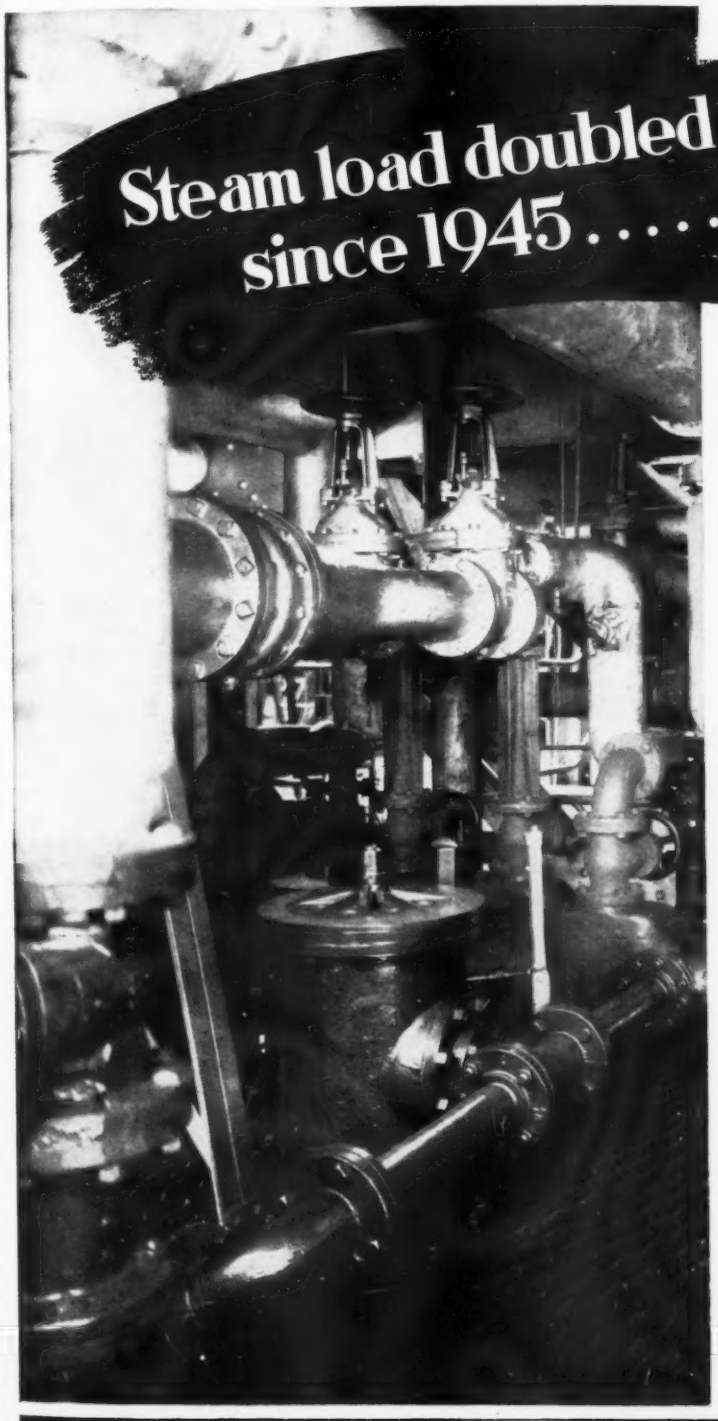
Beginning with the history and development of the screw-cutting lathe this handy book tells how to install and operate a lathe. Numerous illustrations show how to grind cutting tools and adjust them for best results, and how to take measurements. If you have occasion to operate a lathe here is a book you can read and understand. It covers such subjects as, plain turning, chuck work, taper turning, boring, cutting screw threads, drilling and reaming.

WOVEN-WIRE CONVEYOR BELTS FOR INDUSTRIAL APPLICATIONS (1947) *By S Craig Alexander and Fred L Hooper. 56 pp, 5½x8½ in., 84 illust, paper, free. Cambridge Wire Cloth Co, Cambridge, Md.*

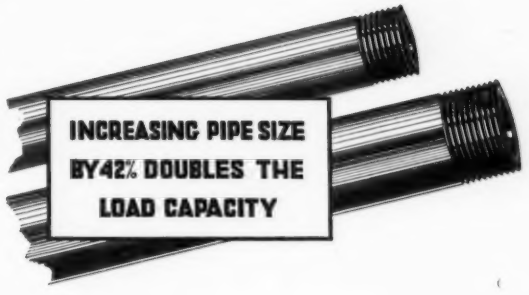
This little book is a compilation of articles on the design, construction, operation and maintenance of woven-wire conveyor belts in industrial application. The wide range of material used in construction of such belts is considered with reference to how various metals and alloys influence the life of woven-wire belts subjected to high temperatures and chemical attack. Different belt weaves are described, showing how design details affect rigidity, strength and service life. Some of the great number of ways that woven-wire belts can be installed are shown and discussed.

(*Continued on page* 148)

INSTALL STEEL PIPING ADEQUATE FOR TOMORROW'S NEEDS



Steam load doubled since 1945 . . . . . "oversize" piping is still adequate



YOU'D think doubling the load would call for extensive--and expensive --plant alterations, including replacement of pipe, valves, fittings, etc. But this was an engineer gifted with foresight. In the reconversion of 1945, he "oversized" his pipe all the way along, 40% to 50% bigger than "will do." He was preparing for what did happen.

Of course, there is a point in this for today's construction work: Looking ahead, with steadily increasing loads very much in prospect, isn't it cheaper and smarter to pay extra and put in, for example, a 3-inch steel pipe instead of two-inch today, rather than figure on getting by with two-inch now and when necessary, rip it out to install 3-inch in a couple of years?

A few dollars' worth of foresight today is worth more than a fortune in hindsight tomorrow--especially when it comes to anything so permanent as good steel pipe.

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Conduit · Bars · Rods · Wire · Cold Drawn Carbon Steel Rounds - Tie Plates and Spikes.

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THAT STEAM!

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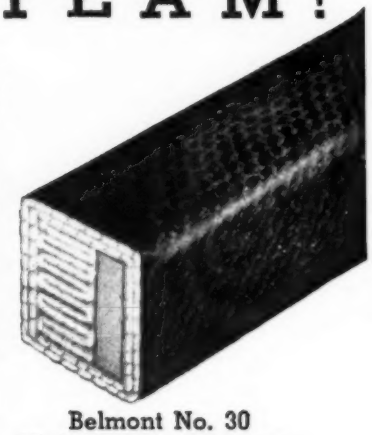
PHILADELPHIA, PA.—To keep pressure up and cost down, modern plants, "leak-proof" moving and stationary parts with Belmont Packings.

Since 1893, Belmont Packings have been solving these problems for industry, with highly specialized packing designs and constructions to meet every industrial requirement. Here, we illustrate just two Belmont steam service leaders. Our catalog displays all.

Belmont No. 30, for high pressure steam rods and expansion joints. Made of closely woven asbestos cloth treated with special rubber compound. Center block pleated on itself (accordian fashion) at approx. 90° angle with rod, affording high resiliency and flexibility. Provides extra take-up and "edgewear" if packing wears toward the rod.



Belmont No. 30
High Pressure Asbestos Packing for rods, expansion joints, air and gas.

BELMONT PACKINGS

Belmont No. 754, for reciprocating rods and plungers against high pressure steam, expansion joints, etc. Made of long fibre asbestos yarn with fine copper wire twisted with each strand. Lubricated throughout and graphited, this square braided packing retains its softness over a long period of use.

Belmont Packings are easy to obtain and convenient to see; distributors are located in every large industrial center, with sample kits displaying Belmont constructions and materials.

Identification is simple. Belmont Packings wherever practicable, are packed in attractive and secure boxes, bearing our orange-colored trade-mark on a blue background.

The Belmont Catalog is available. This invaluable reference book reduces packing facts down to simplest forms. Write on your company letterhead for free copy

Investigate how Belmont can serve you! Contact our local distributor, or write us direct.

Belmont No. 754
Square Braided Asbestos Wire Inserted Packing for reciprocating rods and plungers, expansion joints, etc.

THERE'S A BELMONT PACKING FOR EVERY SERVICE

Steam, Water, Oil, Gas, Air, Acids, Alkalies, Ammonia

Rings, Spirals, Coils, Reels, Spools, Sheets, Gaskets.

THE BELMONT PACKING & RUBBER COMPANY
BUTLER AND SEPVIVA STREETS • PHILADELPHIA 37, PA.

LESSONS IN ARC WELDING, *third edition, 158 pp, 5½x8½, 228 illust, semiflexible simulated leather, $.50. The Lincoln Electric Co, Cleveland, Ohio.*

The completely revised third edition is designed to assist both new and experienced welders as well as others interested in welding. A valuable feature is "Questions & Answers" in the back.

The book explains the fundamentals of arc welding and covers such subjects as alternating-current welding, new procedures with large electrodes, newest electrodes and their use, and data on the qualification of welding operators.

Plant Problems

(*Continued from page* 112)

Slight Cut Is Justified

HE CAN MAKE A LIGHT CUT on his rotor if he takes barely enough to clean off rubbed laminations.

In an induction motor the rotor current flows as the result of voltage induced by the magnetic field of the stator winding. The rotor bears the same relation to its stator that a transformer secondary bears to its primary. Every effort is made in a transformer to have the magnetic circuit closely fitted with a continuous path of iron. In a motor there must be an air gap to give safe mechanical clearance. This distance should be small since the power factor of an induction motor varies inversely with the reactance. The reactance is reduced by a smaller air gap.

A light cut on the rotor will probably help the motor if care is taken to avoid dragging metal across from one lamination to another. The purpose of the laminations is then destroyed and their insulation against eddy currents reduced. These increased eddy currents cause heating and losses greater than that caused by a slight increase in the air gap. **E A Roberts, Commissioner Waterworks System, Carlsbad, N. M.**

A 20% Cut Is Permissible

SIZE OF THE AIR GAP in an induction motor is largely a matter of compromise between performance and the clearance necessary for mechanical reasons.

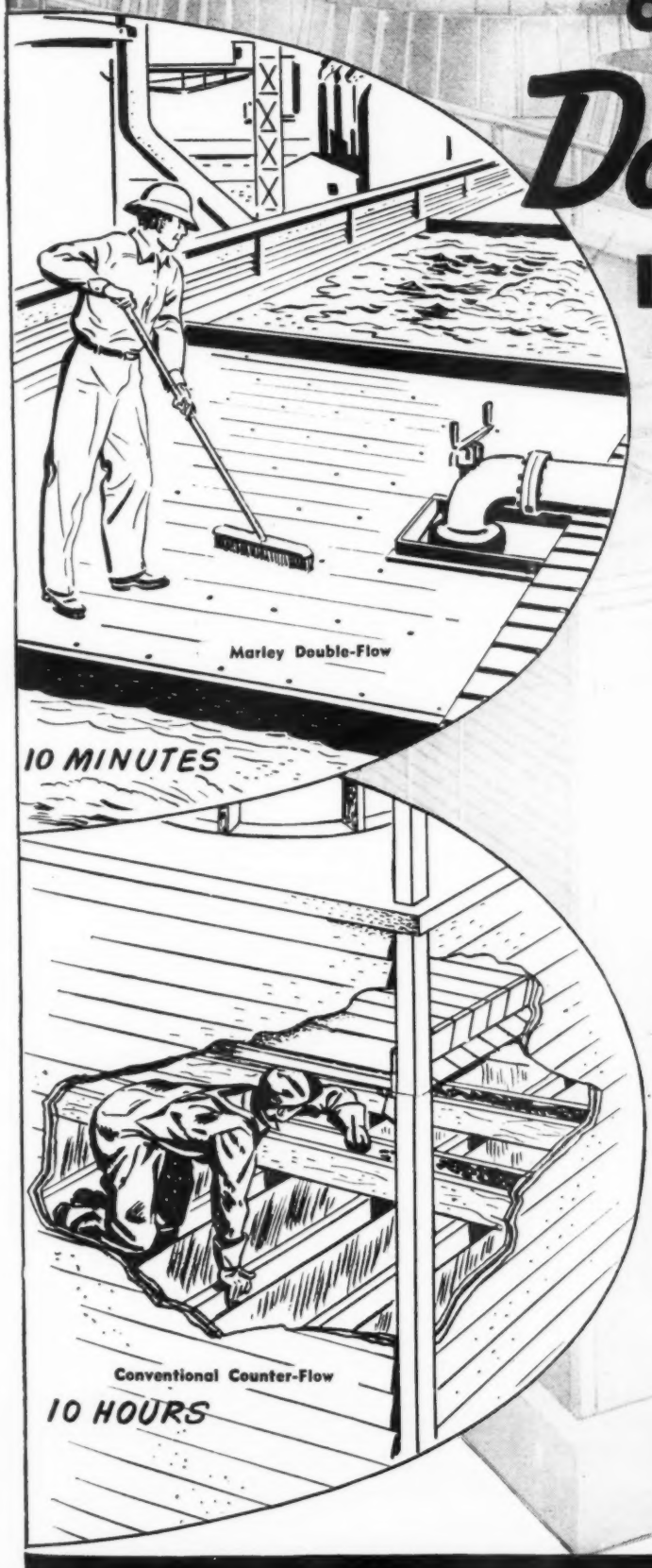
Increasing the air gap up to 20% is permissible in an average motor. The power factor and the general characteristics of the motor will decrease within acceptable limits. The manufacturer will usually be glad to advise you in matters of this kind without charge. As to how much the motor performance will be affected, a blanket answer cannot be given, as each case must be con-

Only a CLEAN Cooling Tower Is Efficient

ONLY A MARLEY

Double-Flow

IS EASILY CLEANED



To maintain efficiency in any cooling tower, the distribution system must be perfectly clean to permit maximum break-up of water. As sediment and algae accumulate, distribution is retarded . . . performance curve lowered.

Only in the *Double-Flow* open distribution system can tower condition be ascertained at a glance. *It is not necessary to shut-down entire tower for either inspection or cleaning.* If cleaning is necessary, the Double-Flow may be cleaned in minutes . . . with no accident hazard involved.

Since it is so easy to keep the Double-Flow in perfect condition, operators accept cleaning as a routine part of operation. It is not an overtime task to be shunned as laborious and dangerous.

Open distribution is just one of many exclusive features that make Double-Flow the industrial leader . . . cooling 8 Billion Gallons of water daily.

MARLEY COOLING TOWERS

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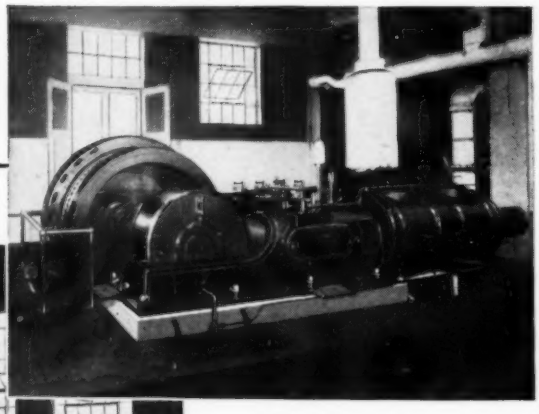
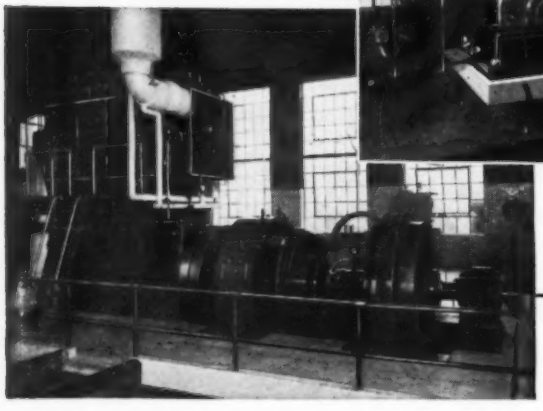
Skinner "UNIVERSAL UNAFLOW"

The Most Economical STEAM ENGINE Built

for Generating Electric Power or Driving Compressors, Blowers, Pumps, Lineshafts . . .





300-Kilowatt Horizontal "Universal Unaflow" in Meat Packing Plant

4-Cylinder Vertical 800-Kilowatt "Universal Unaflow" in Plant of Machine Tool Manufacturer

YEAR after year the sales of Skinner "Universal Unaflow" Steam Engines continue to grow; old customers install additional units; new customers replace purchased power with power generated under their own roof, or replace other types of prime movers with "Universal Unaflow" engines.

The "Universal Unaflow" is not just another steam engine; it is the outstanding reciprocating steam prime mover of this era. The performance of thousands of "Universal Unaflow" engines, in almost every type of industry and institution, daily demonstrates the truth of our claim—that they are "the most economical steam engines built."

"Universal Unaflow" engines are correctly designed for simplicity, dependability, heavy duty service, flexibility, and permanently maintained economy. They are built for direct connection, coupling, or belt drive, to electric generators, compressors, blowers, pumps, lineshafts, or other load. They are available in sizes ranging from 50 to 2000 hp., and in horizontal or multi-cylinder vertical types.

Write us for details, and for information about the performance of "Universal Unaflow" Steam Engines in your particular type of industry.

For Over 75 Years, Doing One Thing Well—Building Steam Engines

SKINNER ENGINE COMPANY, ERIE, PA.

sidered individually. Only a competent design engineer in possession of the original design and performance data should be consulted. **J A Coulden, Hamilton, Ont.**

Misalignment Causes Rubbing

TURNING THE ROTOR DOWN will affect the motor's performance. The air gap of induction motors is small, varying between 0.8 on 3.0 mils; therefore the rotor will rub the stator if the bearings are worn or out of alignment to any applicable degree. Hence a small cut is needed.

In designing a motor, the engineer will work out a rough design for various sets of values; those giving the best results at a minimum cost will be chosen. Often the finished motor will fall short of design calculations, complicating the problem of predicting what changes would occur if the rotor were cut. **Richard Arnot, Kearny, N. J.**

Give Bearings Attention

ROTORS MAY BE TURNED, but at the expense of efficiency. Motors are designed to give this maximum efficiency with a small air gap. Turning down the rotor reduces the torque per ampere, the speed, and the maximum power available, the amount depending on the design of the motor. A similar condition occurs with unequal air gaps. It is much better to maintain the correct air gap by proper attention to the bearings. Turning rotors should be avoided as it always affects the motor's running characteristics and may cause unbalance. **W E Warner, Woodford Green, England.**

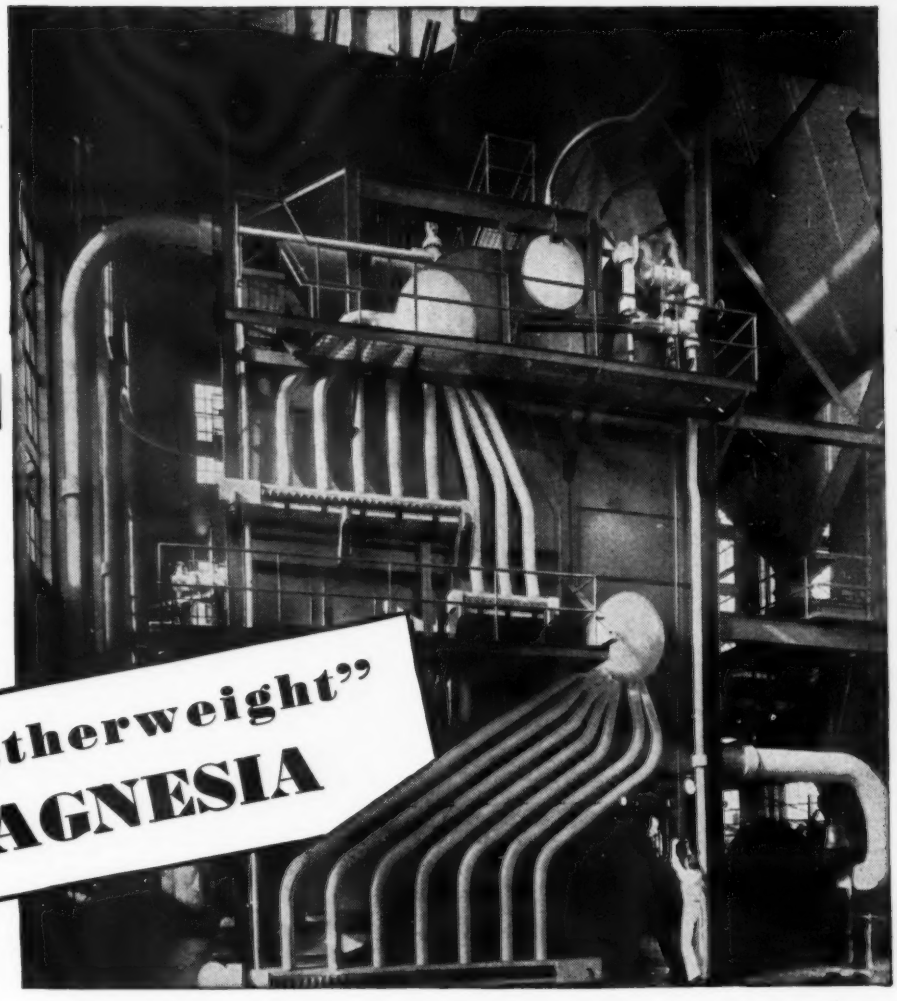
Standardization

(*Continued from page* 75)

would be the chief beneficiaries.

Look at the Future. Recognition by manufacturers and users of steam turbines that both will gain from standardization is necessary before any progress can be made. The first step ahead might well be the establishing of users' committees to work with manufacturers' committees in setting up guides for the building of new power plants, and recommendations for the extensions of existing power plants. These standards should be progressive, should be capable of future advancement, and should lead to economies in the initial cost of power-generating equipment, and economies in operating cost of this equipment.

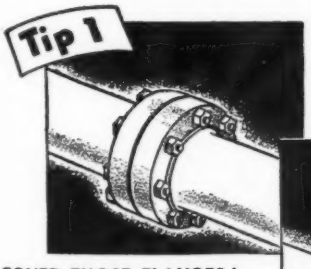
"Featherweight" 85% Magnesia application in a large distillery, where temperatures must be accurately controlled . . . showing insulated drum ends, water wall piping and headers.



How to S-T-R-E-T-C-H your fuel supply

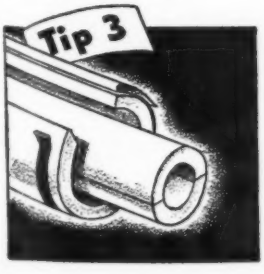
K&M "Featherweight" 85% MAGNESIA

3 TIPS TO HELP YOU SAVE FUEL!



COVER THOSE FLANGES!
On a 10" line at 150 lbs. steam pressure, you can save *approximately ½ ton of coal per flange* per year . . . simply by insulating all bare flanges with "Featherweight!"

COVER THESE, TOO!
Similarly, gain further fuel savings by covering all valves, elbows and other fittings in the steam lines.



SPECIFY THE BEST
To be sure of maximum fuel efficiency, minimum heat loss, be sure all lines are covered with "Featherweight" 85% Magnesia.

With coal so hard to get these days . . . and *all* fuel a costly item . . . it's more important than ever to squeeze that last BTU out of your fuel supply.

You can be sure of minimum heat loss and low fuel consumption if you standardize on K&M "Featherweight" 85% Magnesia insulation. Designed for pipes carrying up to 600°F., "Featherweight"—under various service conditions—has proved to be the most efficient insulation of the moulded type. It is light in weight, fire-proof and extremely durable.

Send for full technical information about "Featherweight" . . . and find out how it can help you gain more power with less fuel, at less cost.

Nature made Asbestos . . .
Keasbey & Mattison has been making it serve mankind since 1873.

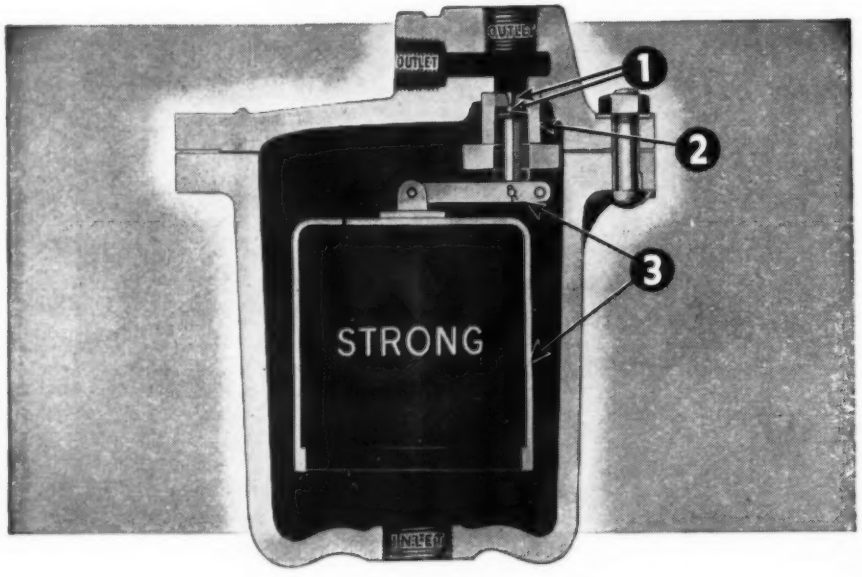
Reg. U.S. Pat. Off.

KEASBEY & MATTISON
COMPANY • AMBLER • PENNSYLVANIA
IN CANADA—ATLAS ASBESTOS CO., LTD., MONTREAL, TORONTO, WINNIPEG and VANCOUVER

3 Reasons

STRONG* Traps

are easy to maintain!



Look for these three STRONG low-maintenance features in the STRONG 80 Series Inverted Bucket Trap:

1. **Anum-Metl Valve and Seat—guaranteed leakproof for one year;**
2. **Bolted-in seat design—insures tight seal, easy servicing;**
3. **Stainless steel bucket and trim.**

Compare these features with other traps!

STRONG 80 Series Trap sizes ½" to 2½", pressures to 250 lbs., temperature to 500° F. (forged steel for higher pressures).

Dual outlet simplifies piping, bottom inlet keeps trap cleaner. Years of trouble-free operation assured by super-STRONG construction.

Catalog No. 67 describes inverted, open bucket and other types of STRONG traps. Write today.

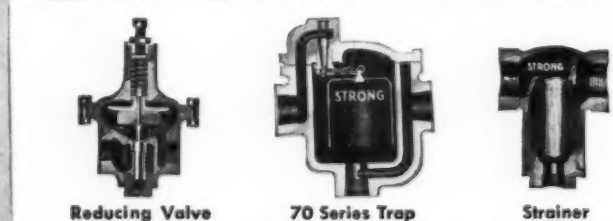
*Trade Mark Reg. U. S. Pat. Off.

STRONG, CARLISLE & HAMMOND COMPANY
1392 West 3rd Street
Cleveland 13, Ohio

REG. TRADE MARK

ANUM-METL Reg. Trade Mark

OTHER STRONG STEAM SPECIALTIES



Reducing Valve | 70 Series Trap | Strainer

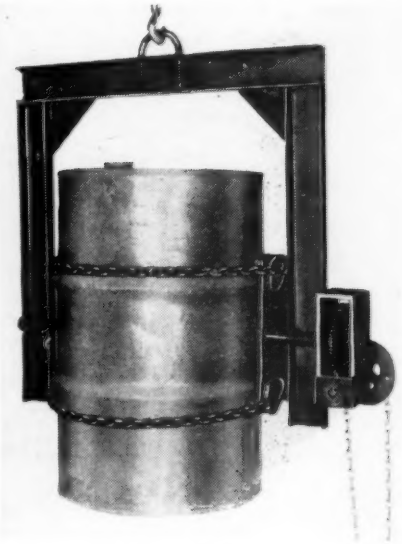
STRONG

New Equipment

(*Continued from page* 122)

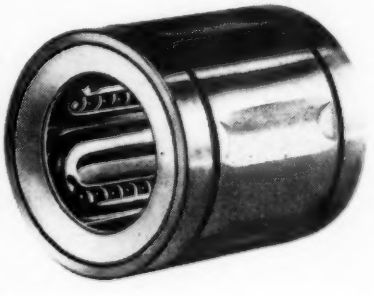
fact that by shifting phase angle of voltage a proper amount, any watthour meter can be made to read kva hr. Thus if power factor of load is known to be about 87%, shifting voltage by 30 deg causes watthour meter to read kva hr directly.

Five transformers are available: Type *K*-12 for 2-phase, 3-wire; *K*-13 for 3-phase, 3-wire; *K*-14 and 18 for 3-phase, 4-wire, and *K*-17 for 3-phase, 4-wire delta connections. **Westinghouse Electric Corp, Box 868, Pittsburgh 30, Pa.**



Drum and Barrel Tilt E94

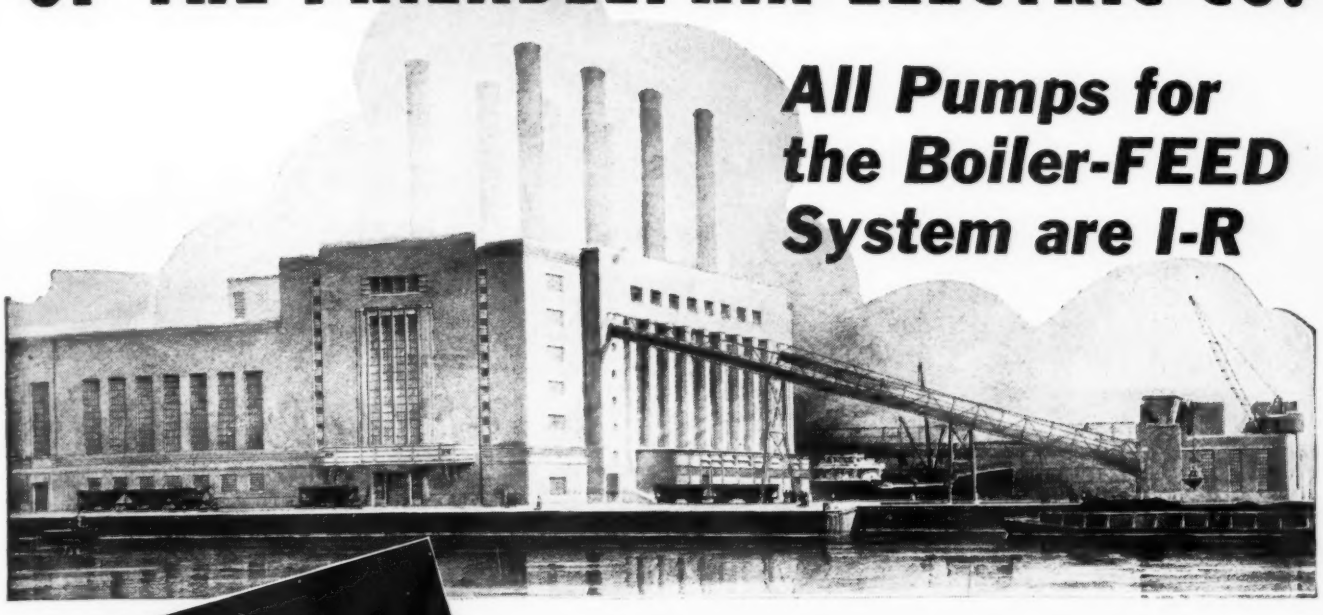
DESIGNED TO SIMPLIFY material handling and eliminate hand dumping, this new drum and barrel tilt saves time in industrial plants. It is used for controlled dumping of chemicals, liquids, plastics, molding powder, scrap and glass. Tilt is built of welded structural steel, in sizes to suit requirements, and weighs about 125 lb. It is equipped with safety locking devices that hold barrel without slippage. Barrel can be turned 360 deg by worm-gear turning mechanism. **Palmer-Shile Co, Detroit, Mich.**



Linear Ball Bearing E95

UNLIMITED-TRAVEL ball bearing is for linear or reciprocating motion. A self-contained unit, it has only three parts in addition to the balls. These include a sleeve made

AT THE NEW SOUTHWARK STATION OF THE PHILADELPHIA ELECTRIC CO.



All Pumps for the Boiler-FEED System are I-R

18 PUMPS TOTALING 15,150 HP

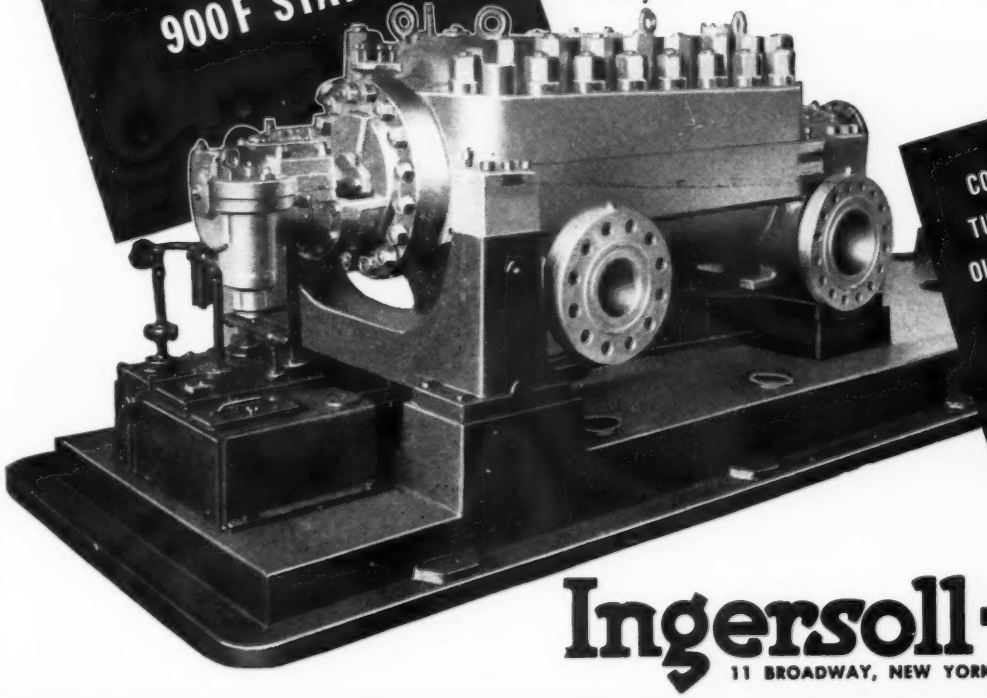
Serve

300,000 KW, 850 PSI, 900F STATION

The six high-pressure feed pumps are 2400 gpm, 770 psi total head (discharge pressure approximately 1275 psi), 7-stage units operating at 1750 rpm.... Low pressure units of the same general design are each 2000 gpm, 550 psi total head, 5-stage, 1750 rpm....The six vertical condensate pumps are 2200 gpm, 130 ft total head, 860 rpm.

Other Ingersoll-Rand pumps in the station include those for hydrogen cooling, for boiler filling, for city water and for water-seal service. Two large synchronous motor-driven I-R compressors furnish the air for station service.

Our engineers will appreciate the opportunity of working with you.



COMPRESSORS
TURBO BLOWERS
OIL & GAS ENGINES
PUMPS
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AIR TOOLS
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11 BROADWAY, NEW YORK 4, N. Y. 10-918

You get
FULL RANGE
(ZERO to 100 PER CENT)

in a HENSZEY FLOW INDICATOR

This rugged and accurate instrument indicates flow over its entire range — from zero to 100 per cent — indicating a pulsating flow exactly as it occurs. The graduations on the easy-to-read dial are uniformly spaced and read direct — without constants.

So, if you need accurate information on "how fast it is running" — instantly and accurately — plan for the installation of Henszey Flow Indicators. Installations satisfactorily performing in Paper Mills, Chemical Plants, Petroleum Refineries, Milk Condenseries, and other varied industries.

Sizes range from 10 G.P.M. to 600 G.P.M. Pipe connections ¾" to 4".

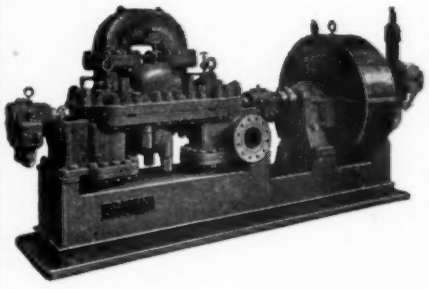
Send for Bulletin FI-1.
HENSZEY COMPANY
Dept. D3, Watertown, Wis.

HENSZEY

FLOW INDICATORS

Continuous Blowdown • Distillation Systems • Heat Exchangers
Feed Water Meters • Boiler Feed Regulators • Proportioning Valves
also MILK EVAPORATORS and PRE-HEATERS

of ball-bearing steel, hardened and ground to close tolerances, a pressed-steel ball retainer, and a pair of rings pressed on sleeve ends to position and secure ball retainer. Series *A* ball bushing is available for ¼-, ½-, ¾- and 1-in. shafts. **Thomson Industries, Inc, 1029 Plandome Rd, Manhasset, N. Y.**



High-Pressure Pumps E96

SIX-STAGE HIGH-PRESSURE centrifugal pumps are for boiler pressures up to 1200 psi. Pumps are designed to be in both axial and radial hydraulic balance. Labyrinth casing and impeller wearing rings, back rings on impellers, stepped interstage seals and grooved rings insure maintained efficiency. Suction pressure, only on both stuffing boxes, increases packing life. Heavy-section hardened shaft and interstage sleeves are packed between sleeve nuts. Pumps have *Kingsbury* thrust bearing and ring oiled and water-cooled plain sleeve bearings. Ball-bearing designs are available. Services include boiler feed, pipeline, mine drainage, debarking and other high-pressure applications. **Warren Steam Pump Co, Warren, Mass.**

Amplidyne Control E97

PACKAGED AMPLIDYNE CONTROL is for steel mill and processing line control applications where speed, current or voltage regulation are required. This unit brings together all adjusting rheostats, capacitors, rectifiers and instruments required for the amplidyne-regulating circuit.

In addition to performing all necessary functions associated with regulating control circuits, this package unit provides motor speed limit control, field forcing

Carload of *power savers!*

Our No. 49900
Customer's No. 37241
NEBRASKA PUBLIC POWER SYSTEM
BELLEVUE POWER STATION
BELLEVUE, NEBRASKA
FROM
AMERICAN BLOWER
AMERICAN BLOWER CORPORATION
DETROIT 32, MICHIGAN, U. S. A.
MANUFACTURERS
INDUSTRIAL FANS · AIR CONDITIONING · COMFORT COOLING · VENTILATING
HEATING · DRYING · MECHANICAL DRAFT · FLUID DRIVES · DUST COLLECTORS

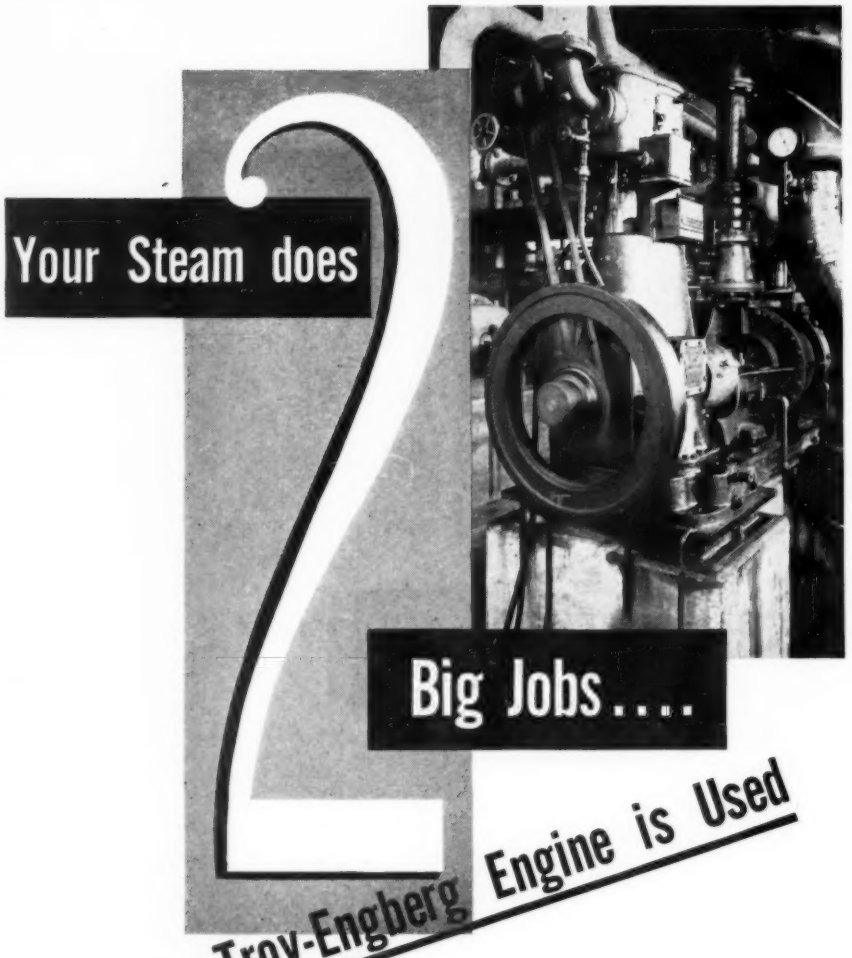
GYROL FLUID DRIVE for adjustable speed control of mechanical draft fans and boiler feed pumps is getting more and more popular!

Why? Because Gyrol Fluid Drive saves power and increases overall plant efficiency.

AMERICAN BLOWER CORP., DETROIT 32, MICH.
CANADIAN SIROCCO CO., LTD., WINDSOR, ONT.

AMERICAN BLOWER

Division of AMERICAN RADIATOR & Standard Sanitary CORPORATION



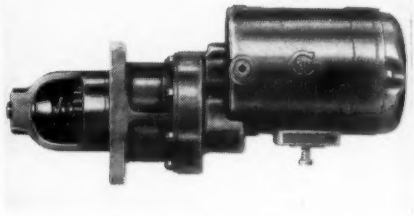
With proper plant heat balance your steam may do two big jobs. If you generate steam for processing or heating a Troy-Engberg Steam Engine can produce By-Product Power at a very low cost. The same steam then yields power as well as heat units!

It's the simplest story in the plant. Steam is first passed through the engine — driving pumps, stokers, compressors, blowers or generators. Then the exhaust, with most of the original heat units still intact, is used for processing or heating. And for dependability nothing beats the standard counterflow steam engine . . . no interruptions from power failure.

TROY ENGINE & MACHINE COMPANY
(Established 1870)
2500 Railroad Avenue **Troy, Pennsylvania**

TROY-ENGBERG
STEAM ENGINES • GENERATING SETS • GENERATORS

during acceleration and deceleration, and stabilizing functions. Unit can be mounted on front of main panel board or recesses in the panel. It can also be mounted in back of board, if desired. All adjustments may be made with a screwdriver by opening front cover. Once an adjustment is made, it is clamped by a locking device. **General Electric Co. Schenectady 5, N. Y.**



Air Starter for Diesels E98

NEW STARTING UNIT for diesel engines consists of a 7-hp air motor with a Bendix starting drive. Unit, 18 in. long by 5½ in. diameter, mounts on any diesel by a SAE No. 2 flange. It will handle engines up to 600 cu in. displacement.

Providing the inherent reliability of air starting, this unit offers reasonable initial cost and, because of simple and rugged design, maker claims that upkeep is negligible. **Chicago Pneumatic Tool Co. 6 East 44th St, New York 17, N. Y.**

Excess-Smoke Indicator E99

TYPE 2A10C gives a continuous indication of uptake gases, signaling when either smoke or air are excessive enough to cause inefficient combustion or create a smoke problem. Indicator is for factories, hotels, hospitals, universities and utilities. It operates on 115-v ac. The control consists of a single phototube operating a dual relay system that indicates combustion conditions on the *D*33 Densometer located on boiler-room instrument panel. Equipment is enclosed in dustproof, moistureproof housing. **Photoswitch, Inc. 77 Broadway, Cambridge 42, Mass.**

BE SURE IT'S A

Genuine TOLEDO THREADER

YOU'LL SAVE TIME...CUT COSTS!

Put genuine TOLEDO Pipe Tools in the hands of your mechanics—they'll do *better work, faster* and *cut costs!*

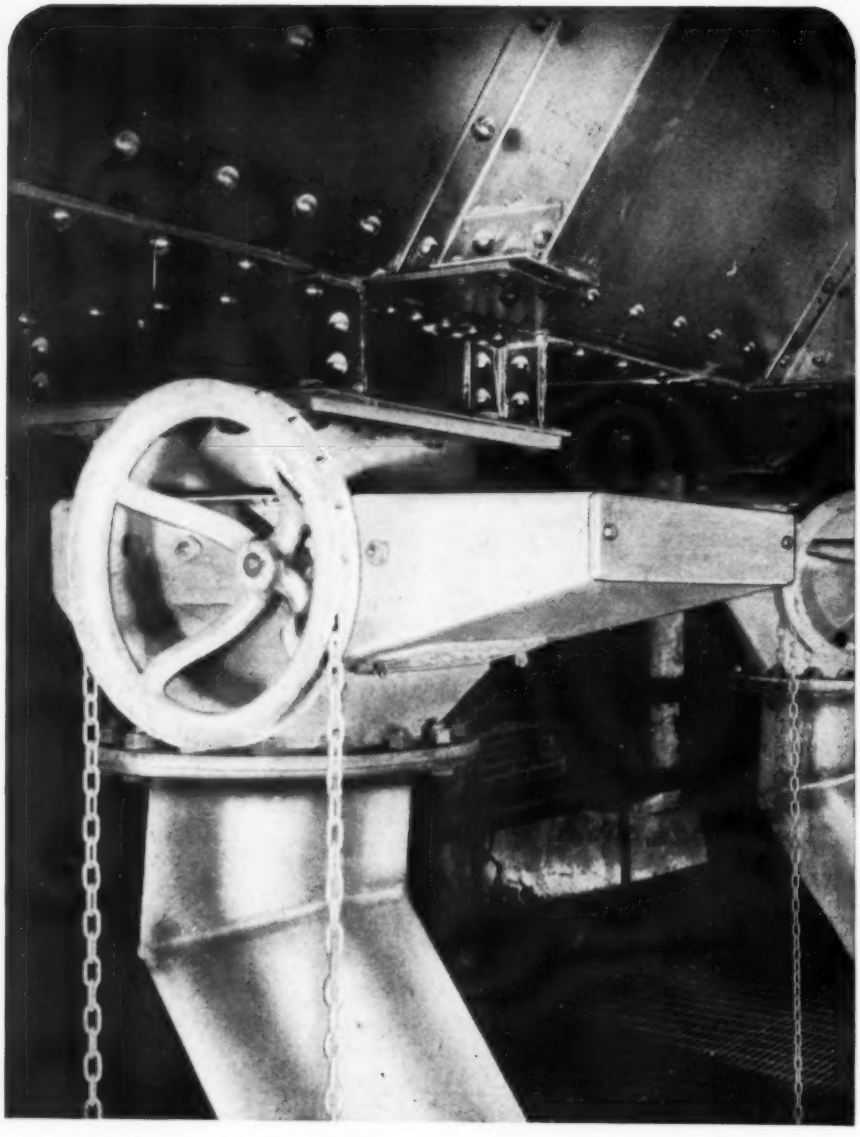
These are the easy-threading tools preferred by experienced pipe fitters for nearly half a century. They're Toledo-engineered for accuracy . . . and day-in and day-out dependability. There's satisfaction on the job . . . when you tool up *right* with TOLEDOS! The Toledo Pipe Threading Machine Co., Toledo, Ohio. New York Office, No. 2 Rector Street Building.

Toledo Small Ratchet Threaders made in three models, 1/8" to 2" pipe.

RELY ON THE LEADER

TOLEDO

FOR PRECISION PIPE TOOLS



1/2 OF ALL OF THE NEW COAL BURNING CENTRAL STATIONS ARE USING

S. E. Co. Coal Valves

Recent investigation as to the popularity of S. E. Co. Coal Valves indicate the above fact. The reason — operators knowledge that these valves work easily, under any and all conditions.

For catalog, write STOCK ENGINEERING COMPANY, 715 Hanna Building, Cleveland 15, Ohio.

STOCK ENGINEERING CO.

★ CONICAL Non-Segregating Coal Distributors ★ S.E.CO. Coal Valves and Coal Scales

Power News

(*Continued from page* 132)

A group of Shanghai bankers have agreed to advance the Chinese dollar portion with the full understanding that no dividends or income will accrue to their stock until the dollar bonds are paid off in full. Although this may take 15 years, their belief is that economic life of Shanghai requires additional power and that the foreseeable improvements in industrial conditions will provide enough income.

Five existing power companies with franchises to serve sections of Greater Shanghai will have priority in acquiring the stock securities of UPC. To the extent that they invest in UPC, they have the right to buy a proportionate amount of the power output. UPC will not set up consumer distribution networks of its own, but will sell power to the present franchised distributors.

In addition to the generating plant, the proposal calls for a 54-mile overhead belt-line transmission system. It will be a 132,000-v system.

Present generating capacity of Shanghai's power companies is 205,000 kw, with an additional rehabilitation of 59,000 kw expected to be completed by the end of 1948.

Shanghai Power now generates about 90% of the total electric energy used in Shanghai. It sells about 20% of output to other franchise companies who lost heavily in equipment during the war.

UPC was proposed to Chinese authorities two years ago, but hopes for American government loans led the government to delay. They expected that with a loan they could do as they pleased —not have to make concessions for repayment of the foreign investment. The 2-year delay has seriously postponed any augmenting of Shanghai's power capacity and set back industrial recovery there about four years. If orders for machinery had been placed in early 1946, delivery would have taken place in 1948. The best offer for orders placed now is 1953.

Westinghouse Electric Corp has shipped the first standardized 30,000-kw turbine generator to Southwestern Public Service Co at their station in Borger, Texas. The turbine-generator is the first unit of this size to be manufactured strictly according to recently released ASME-AIEE standards.

CENTRIFUGAL PUMPS FOR EVERY LIQUID

FINE PUMP CONSTRUCTION

PUMPS by "Buffalo"

Pays You Year after Year!

"Buffalo" Double Suction Single Stage Centrifugal PUMPS
Bulletin 955-L
BUFFALO PUMPS, Inc., Buffalo 5, N. Y.
CANADA PUMPS, Ltd., Kitchener, Ont.

You're buying more than a pump when you select one of the line of "Buffalo" Double Suction Single Stage Pumps — *you're buying years of trouble-free pumping service!* The finest construction goes into every part of these pumps. This construction is not cheap — but it pays off where the pay-off counts — in maintenance savings, higher efficiencies and smoother performance.

- IN CAPACITIES FROM 10 to 10,000 U. S. GALLONS PER MINUTE
- FOR MOST CLEAR WATER SERVICES
- CLOCKWISE OR COUNTER-CLOCKWISE ROTATION
- DIRECT OR PULLEY DRIVE

SEND FOR THIS BULLETIN

Bulletin No. 955 gives all construction and performance data — shows you why "Buffalo" Single Stage Double Suction Pumps give you more for your pumping dollar. Write for your copy!

For

- ★ WATER ANY TEMPERATURE
- ★ PAPER STOCKS (NON-CLOGGING)
- ★ GENERAL SERVICE
- ★ ACIDS
- ★ ALKALIS
- ★ SLURRY
- ★ CONDENSATE RETURN
- ★ SUMP CLEARANCE
- ★ FIRE SERVICE
- ★ SEWAGE
- ★ SELF-PRIMING SERVICE

BUFFALO PUMPS, INC.

488 BROADWAY BUFFALO, N. Y.

Canada Pumps Ltd., Kitchener, Ont.

RUGGED, PRECISION CONSTRUCTION — FOR LONG LIFE

THE *Safe* OPEN STEEL FLOORING IS TRI-LOK

No object over ½ square inch can pass through super-safe U-Type Tri-Lok Flooring. Fabricated without bolts, rivets or welds, it is unsurpassed for plant installation, walkways, loading platforms. Guarantees efficient distribution of concentrated loads . . . maximum free opening for light and air. Write for Bulletin 1140.

DRAVO CORPORATION
NATIONAL DEPARTMENT
1103 PITT BANK BLDG., PITTSBURGH 22, PA.
(Distributor for THE TRI-LOK COMPANY)

DRAVO

One Man at One Point

. . . Controls All!

With Beaumont Birch Coal Handling Equipment, one operator controls *all* coal handling with finger-tip controls, like this—

Coal arrives by rail, is dumped into hopper, raised by bucket elevator and discharged either into bunker for immediate use or down a chute to yard storage. If it goes to storage, the Beaumont Drag Scraper spreads it into safe, compact layers—eliminating air pockets.

Use any available space. Tail-blocks can be slung between posts and moved by hand—and mechanically moved on I-beam track, by tail-block car, or suspended from an aerial bridle system. The scraper and cable system is operated by *one* man through remote control. *One* company, Beaumont Birch, supplies all necessary equipment.

Complete engineering service available by writing right now to—

BEAUMONT BIRCH COMPANY
1502 RACE STREET • PHILADELPHIA, PA.

Designers Manufacturers Erectors BULK MATERIAL HANDLING SYSTEM

T J CONDON, Active Member Of NAPE, Died on Jan 13

Timothy J Condon died on Jan 13 at his home in New York City. Born in Ireland 67 years ago, "Tim" came to New York while still a young man. He became an operating engineer and was for the rest of his life very active in affairs of National Assn of Power Engineers. He was past president of NAPE No. 44, New York, and prominent also in affairs of State and National Associations. He was a member of International Union of Operating Engineers.

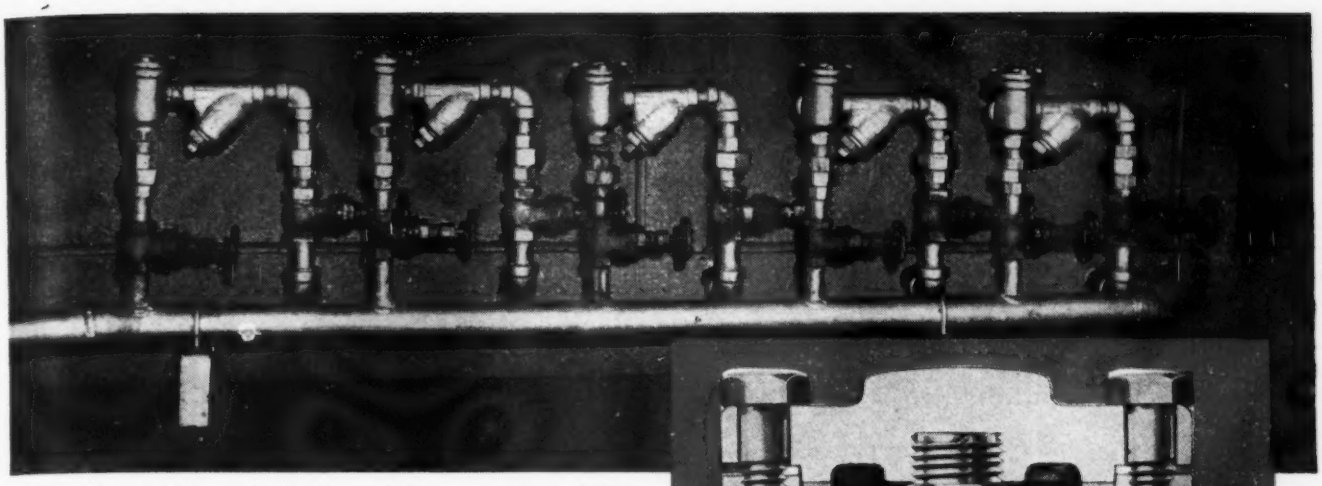
Perhaps his most notable characteristic was a quiet friendliness, so sincere that it was universally reciprocated.

Condon is survived by five daughters and a brother Patrick, one of the charter members of No. 44.

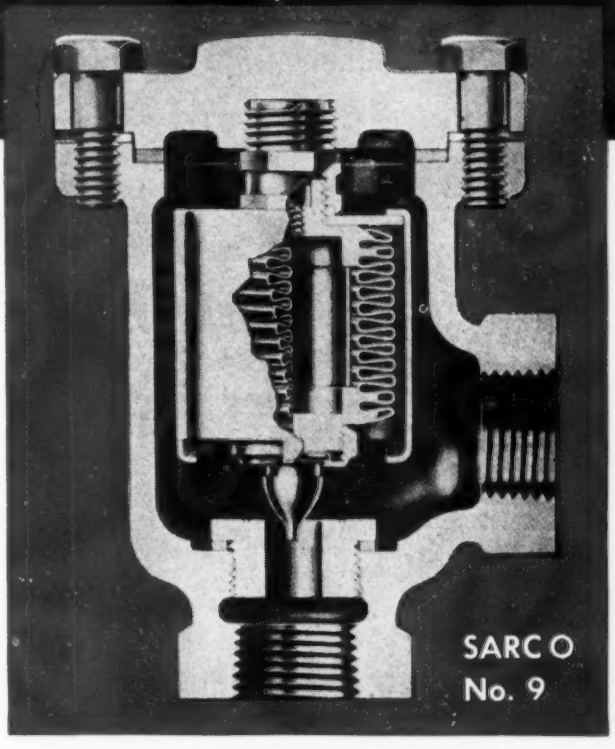
American Relay & Controls, Inc, 2555 W Diversey Ave, Chicago, makers of electrical relays, switches and specialized controls, has been purchased by David T Siegel, Chicago manufacturer. The firm has also moved to a new location at 4900 W Flournoy St, Chicago 44, Ill.

An Institute of Geology has been formed jointly by Massachusetts Institute of Technology and Nova Scotia Dept of Mines, with headquarters at Crystal Farm, near Antigonish, N. S. Extensive investigation of fuel and mineral resources of George's Bay region in Nova Scotia will be conducted cooperatively. Summer courses will be given to MIT and other students, and coal and petroleum resources will be investigated as well as other deposits. The coal mines extending under the sea at Sydney are within 100 miles and the entire region is of varied interest from geological and engineering standpoint.

Technical dept of E F Drew & Co has prepared a 10-min 16-mm motion picture film, with sound, entitled "A Study in Boiler Water Treatment," and is offering this picture, without charge, to engineering societies and other interested groups. The picture covers main difficulties encountered in boiler-water treatment, such as scale and corrosion and their correction. For information concerning use of this film write to *Power Chemicals Div, E F Drew & Co, 15 E 26th St, New York City.*



Sarco No. 9 Thermostatic Steam Traps on ovens. More than 220 Sarcos are used in this plant.



WHY FORD MOTOR CO. INSTALLED SARCO No. 9 Steam Traps

in its Hegewisch Plant, Chicago, Ill.

The heating-up time on the ovens at the Ford plant in Chicago was reduced from three to four hours to less than an hour by using Sarco No. 9 Thermostatic Steam Traps on each individual coil. Production is more reliable and more uniform because Sarco No. 9:

(a) Requires less space.

(b) Will work satisfactorily regardless of pressure changes, making it unnecessary to change orifice due to change of pressure.

(c) Has rapid air venting due to larger valve orifice, allowing rapid heating up from cold start.

(d) Has one working part—the flexible bellow, thus reducing Maintenance cost.

(e) Is one of the few thermostatic traps made with a range from 0# to 225# steam pressure.

(f) Slight additional cost is more than offset by low maintenance cost.

189

SARCO SAVES STEAM

SARCO COMPANY, INC.

Represented in Principal Cities

Empire State Building, New York 1, N. Y.

SARCO CANADA, LTD., TORONTO 5, ONTARIO

THE MODERN WAY to Remove Tramp Iron!

Use the NEW Dings ALNICO MAGNET PERMA•PULLEY*

• Here's the modern, low cost, positive way to remove tramp iron from material carried on conveyor belts. No wiring . . . no electrical accessories . . . no operating cost . . . no maintenance . . . good for life . . . tremendous power . . . completely automatic — The new Dings PERMA-PULLEY is a revolutionary contribution to magnetic separation. You can install it and forget it!

Backed by 50 years of magnetic separator manufacturing experience, this new pulley offers these plus features that assure you of maximum tramp iron removal:

- **Extra high strength grade of Alnico**
- **Closely spaced poles**
- **Magnetic strength equal across entire belt width**
- **Crowned face to prevent belt weave**
- **Extremely high surface strength**

Dings PERMA-PULLEYS are available in 53 sizes with shaft diameters to suit your requirements. Fully described in NEW BULLETIN No. 260-A which includes comparative Magnetic Strength Curve proving that you get greater protection with DINGS! Send for a copy.

DINGS MAGNETIC SEPARATOR CO.
4765 W. McGeogh Avenue, Milwaukee 14, Wis

***MOST POWERFUL NON-ELECTRIC PULLEY ON THE MARKET!**

Dings offers you the most powerful magnetic pulleys for the job:

1. For burden depths up to two inches — The Dings *Perma-Pulley* with its extremely high surface strength.

2. For burden depths over two inches — The Dings "High-Intensity" Electromagnetic Pulley with its great depth of magnetic penetration.

Dings
"HIGH INTENSITY"

MAGNETIC PERMANENCE GUARANTEED *for life!*

Canada's Hydro Development

During 1947 demand for primary power had been expanding in practically all districts of Canada and was nearly 90% above that of the year 1939. As power-producing agencies had generally expected some falling off in industrial activity in early postwar years, little construction was undertaken during 1945 and 1946. Thus, the unexpected heavy demand for energy is resulting in shortages of power in some areas and in the reimposition of restrictive measures on power use, pending completion of new plants.

The total of new installations coming into operation during 1947, while somewhat lower than normal prewar rate of increase, amounted to 178,800 hp; plants now under active construction are expected to add about 500,000 hp during 1948. All together, preliminary investigation, plans and construction activities may be said to cover water power sites having a total estimated capacity of about 2,000,000 hp.

Wide-scale expansion program of B C Electric Railway Co in all three services, hydroelectric, transit and gas, moved forward during 1947 at a rate unparalleled in any previous 12 months, company officials state at Vancouver. In hydroelectric development greatest strides were made on Bridge River project and construction of the $2,000,000 Murrin substation in Vancouver. Manufacturers are busy building the first of two 62,000-hp generating units. When completed the project will deliver 620,000 hp. Also in production are the giant penstocks that will drop water from tunnel above Seton Lake to turbines 1200 ft below. Work is proceeding on erection of 660 steel towers on concrete footings to carry overhead lines bringing Bridge River's output to metropolitan area.

Throughout Canada 19 major power projects are under way to develop another additional 1,300,000 hp of electricity from Canada's rivers. Bulk of the developments are in British Columbia, Ontario and Quebec, but one development that will provide 8,000 hp is under construction in Great Slave Lake area of Northwest territories. Manitoba, Alberta and Nova Scotia have developments under way as well. When these are completed by 1950, Canada expects to have available from its rivers about 11,600,000 hp of electricity, about 20% of the potential electricity that can be supplied from rivers and lakes that have been surveyed.

Roughly 50% of potential electric power from rivers and lakes is in provinces of Ontario and Quebec and 83% of developed water power is in those two provinces.

There are five projects under way in Ontario, accounting for 706,000 hp, and one was completed in 1947. In Quebec there are six plans being pushed, with a total of 288,000 hp. British Columbia has 180,000 hp under development on two rivers and Manitoba has 80,000 hp at two falls.

One tape that does the work of TWO

For literally a countless number of uses in plant, shop and home, Anchor Duo-Tape is finding wide favor. This new tape, introduced only two months ago by The Anchor Packing Company, is a multi-purpose tape, having very strong adhesion and the layers will fuse or weld together with slight finger pressure.

Ideal for insulating both inside and outside wiring and in the maintenance and repairing of motors, generators, transformers and similar equipment. Also for repairing rubber hose and tubing, lamp cords, etc. It does the work of two tapes, and only DUO-TAPE is needed. Approved by Underwriters' Laboratories.

Write today for new booklet describing ANCHOR DUO-TAPE fully.

THE ANCHOR PACKING COMPANY

GENERAL OFFICES: PHILADELPHIA, PA.

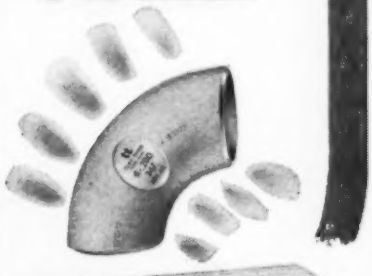
FACTORIES: MANHEIM, PA., ELKHART, IND., MONTREAL, CAN.

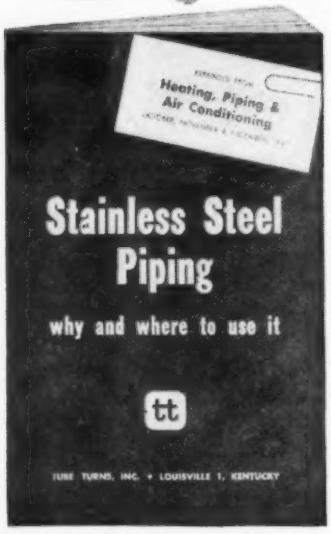
BRANCH OFFICES

Gay & Lombard Streets	Baltimore 2, Maryland
150 Causeway	Boston 14, Massachusetts
Andrews Building	Buffalo 2, New York
Rockefeller Building	Cleveland 13, Ohio
900 South Wabash Avenue	Chicago 5, Illinois
174 North Cassingham Road	Columbus 9, Ohio
4 West 7th Street	Cincinnati 2, Ohio
642 Beaubien Street	Detroit 26, Michigan
509 Washington Avenue	Houston 2, Texas
720 Mateo Street	Los Angeles 21, California
903 East Kilbourn Avenue	Milwaukee 2, Wisconsin
418 Common Street	New Orleans 4, Louisiana
100 6th Avenue	New York 13, New York
401 North Broad Street	Philadelphia 8, Pennsylvania
405 Penn Avenue	Pittsburgh 22, Pennsylvania
Terminal Sales Building	Portland 5, Oregon
156 South Park	San Francisco 7, California
2207 1st Avenue South	Seattle 4, Washington
1407 Pine Street	St. Louis 3, Missouri
921 South Richmond Street	Tulsa, Oklahoma

What about

STAINLESS STEEL PIPING?





GET THIS BOOKLET

Stainless Steel Piping—Why and Where to Use It: This 24-page booklet reprints a series of articles from the publication, Heating, Piping, and Air Conditioning. Covers the subject thoroughly, and discusses applicable welding processes. Mail coupon today.

TUBE-TURN TUBE-TURN—*T. M. Reg. U. S. Pat. Off.*

WELDING FITTINGS AND FLANGES

District Offices at New York, Philadelphia, Pittsburgh, Detroit, Chicago, Houston, Tulsa, San Francisco, Los Angeles

Tube Turns, Inc., Dept. 4202
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Please send "Stainless Steel Piping" booklet.

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Edmonton, Alberta, To Add 30,000 Kw

Work is being pushed ahead at the municipally owned power plant at Edmonton, Alberta, on extension and construction involving about $3,000,000, which it is expected will be completed before the end of 1948. About $1,770,000 in extensions to the power plant should be completed at that time. The $1,270,000 new water filtration plant adjacent to the power plant should be in operation by late spring.

Already the largest central station steam power plant in Canada, the extension is being made for a 30,000-kw steam turbine-generator. Its cost is $688,500 and W I McFarland, power-plant superintendent, said it should be in operation next Nov. It will take some of the load off the two newer turbines, one installed in 1939 and the other in 1943, each 15,000 kw, and the two old turbines, one a 10,000 kw and the other a 4000 kw. When new unit goes in service the plant will have 74,000 kw, which makes it by far the biggest steam power plant in Canada.

Structural-steel work is progressing rapidly and Dominion Bridge Co steelworkers are completing construction of a 9000-ton coal bunker above the two 155,000-lb-per-hr boilers, valued at $590,000, which will be ready for service in July. Structural steel work, along with removal of old walls and foundations, will be a $200,000 job. Construction is being done by Poole Construction Co. Included in the improvements are: boiler feed pumps, $23,062; steam piping and valves, $57,000; additional feed piping, valves and circulating-water piping, $30,000; coal weigh larry, $24,000.

Worcester Engineering Society established in 1946 the Admiral Ralph Earle Award to be given each year to the engineer, under 35 years of age and residing in Worcester County, who during the year had made the most outstanding engineering contribution. The award consists of a medal, a certificate of meritorious achievement and the sum of one hundred dollars. First recipient of the award for 1947 was Earle C Miller, design engineer of Riley Stoker Corp. Miller was chosen to receive the award for his outstanding engineering work on development and design of Riley spreader stokers and because of many unique design characteristics of these stokers.

Under leadership of American Society of Refrigerating Engineers, up-to-date provisions for safe use and application of mechanical refrigeration are being prepared by a nationally representative committee. The committee has been reorganized by American Standards Assn to undertake a revision of the 1939 American Standard Safety Code for Mechanical Refrigeration. The code is being revised with two purposes in mind: (1) to put it in a form that will be most easily used by municipal and state authorities (2) to bring it up to date so safety requirements will be applicable to all the new types of refrigeration equipment.

For Your Next Job
STOP and CONSIDER the

FLEXIBILITY

of the

Peerless Vertical Turbine Pump

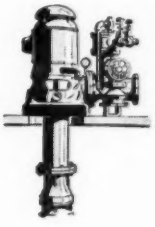
1. AS A DEEP WELL PUMP

For a dependable source of clean water, Peerless Vertical Turbine Pumps are recognized leaders in the field; noted for their adaptability to widest pumping conditions. Install these deep well pumps with the type of drive most suitable to your application. Capacities from 15 to 30,000 g.p.m. are obtained from all practicable depths.

2. AS A CLOSE-COUPLED PUMP

You're assured of full turbine pump utility and capacities with an extremely compact installation. Ideal for pumping from short or medium settings; capacities up to 30,000 g.p.m. are delivered from sumps, pits and surface water sources. For booster service, circulating, de-watering and a host of other applications.

3. AS AN APPROVED FIRE PUMP



Install this versatile Peerless Vertical Turbine type Fire Pump, with proper fittings, for a permanent and reliable water supply for adequate plant fire protection. *Underwriters approved*, these pumps produce from 500 to 2000 g.p.m. against heads to 285 ft. Extremely simplified in piping arrangement.

Engineering Information Available on All Three Vertical Turbine Types

Write to nearest office stating what your pumping conditions are; give diameter and depth of well, distance to water, capacity desired, total head, type of lubrication (oil or water) and type of drive. The bulletin that specifically describes the pump to fit your specific needs, together with appropriate engineering data will be furnished. Plan with Peerless Vertical Turbine Pumps!

fmc PEERLESS PUMP

PEERLESS PUMP DIVISION

Food Machinery Corporation

Factories: Los Angeles 31, Calif.; Quincy, Ill.; Indianapolis, Ind. ***District Offices:*** Chicago 40, 4554 North Broadway; New York 5, 37 Wall Street; Atlanta Office: Rutland Building, Decatur, Georgia; Dallas 1, Texas; Fresno, California; Los Angeles 31, California

Eliminate Banking Losses

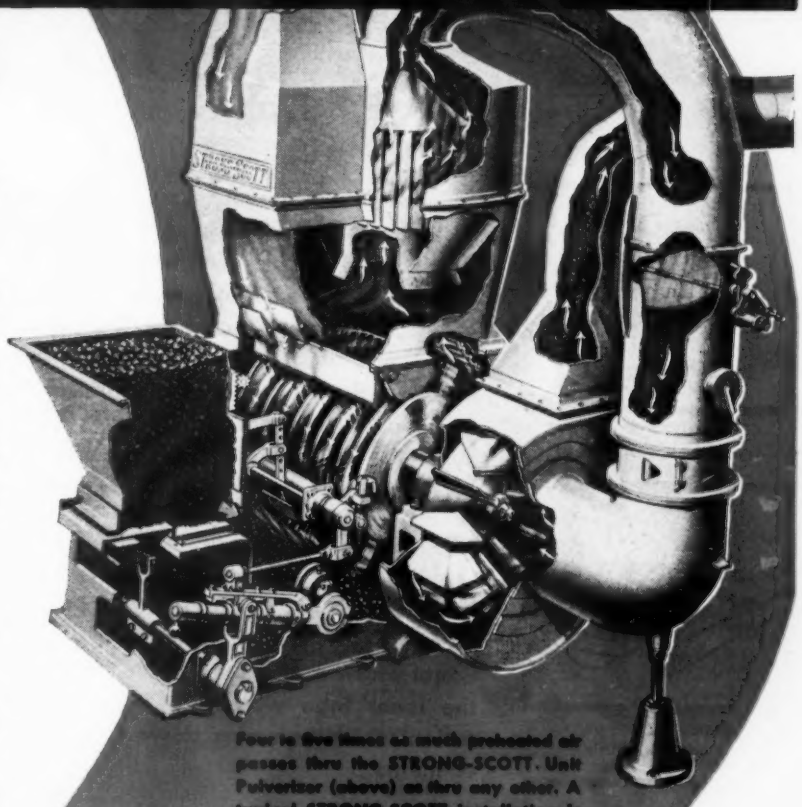
by direct firing coal with a STRONG-SCOTT UNIT PULVERIZER

● Direct-firing with pulverized fuel saves the fuel wasted by banking on stoker fires at night. With a STRONG-SCOTT Unit Pulverizer, your furnace responds as quickly as gas or oil, yet burns economical . . . cheap . . . grades of bituminous coal.

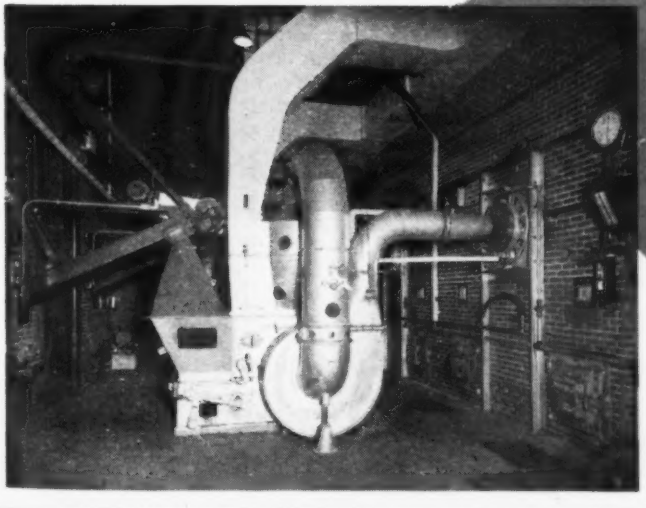
Quick, easy re-lighting gives you a hot fire immediately, or from a cold start, you *can* have maximum steam output in half an hour when such emergencies occur.

Advantages

- **Fires continuously and uniformly** whether fuel is wet or dry; high or low grade; fine, or even with occasional 4" lumps.
- **Burns any bituminous coal** or by-product pitch with only simple adjustments. Provides maximum flexibility of operation.
- **Handles wet coal better** because 4 to 5 times as much preheated air passes thru the grinding chamber as thru any other pulverizer. Dries thoroughly as it grinds.



Four to five times as much preheated air passes thru the STRONG-SCOTT Unit Pulverizer (above) as thru any other. A typical STRONG-SCOTT installation is shown below.

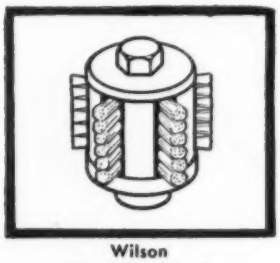


STRONG-SCOTT *dependability, service* and performance are guaranteed and backed by 52 years of manufacturing experience —24 in the combustion engineering field. Over 40% of our business is repeat orders. There are hundreds of STRONG-SCOTT Unit Pulverizers in over 200 American cities and several foreign countries. VISIT ONE OF THESE and see with your own eyes its simple, rugged design, its flexibility and adaptability to varying local conditions.

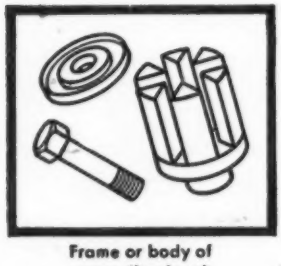
WRITE FOR BULLETIN. Send for descriptive Bulletin with complete information. *Names of customers in your vicinity furnished on request.*

The STRONG-SCOTT Mfg. Co.
455 TAFT STREET N. E. • MINNEAPOLIS 13, MINN., U. S. A.

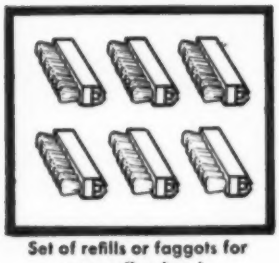
STRONG SCOTT
UNIT PULVERIZER



Wilson Expanding Brush



Frame or body of expanding brush



Set of refills or faggots for expanding brush

Ten to twenty times as many tubes can be cleaned with a Wilson Expanding Brush than with ordinary sectional brushes before replacement is necessary. When removing the light, powdery deposits or for final polishing of tubes, the savings in time, labor and money derived from this feature alone make the expanding brush an essential part of very tube cleaning equipment.

This longer life results from the expanding action of the brush. Because any brush must be smaller than the I.D. of the deposit it removes, the ordinary sectional brush cleans by vibrating against the inner tube wall with a pounding action which hammers down the brush elements.

In the Wilson Expanding Brush, centrifugal force holds the tufts in constant contact with the deposit — eliminating this destructive pounding. Worn tufts in the Wilson Expanding Brush can be replaced easily and quickly — and at low cost.

A copy of the Wilson Tube Cleaners Check List will help you select the right Wilson equipment to do your tube cleaning jobs faster and more effectively. Write for your copy today.

MODERN TUBE CLEANERS FOR THE PROBLEMS OF TODAY

TW-696

THOMAS C. WILSON Inc.
21-11 44th AVENUE, LONG ISLAND CITY 1, NEW YORK

APPOINTMENTS

Edward Valves, Inc, has named Charles H Tate Co as its representative for northern Ohio and Erie County, Pa. The Tate Co has added J M Watson to its sales engineering staff. Watson will specialize in Edward line of cast- and forged-steel valves. Tate offices are at 992 Union Commerce Bldg, Cleveland 14.

Howard L Phillips has been appointed assistant export manager of **Nordberg Mfg Co,** Milwaukee 7.

Bailey Meter Co, Cleveland, announces appointment of G R Mays as manager of its St. Louis branch office at 4030 Chouteau Ave. He succeeds L E Evans, who resigned. New branch offices have been opened in New Orleans, La., and Schenectady, N. Y. New Orleans office, which was formerly a subdivision of Houston office, is at 2176 Esplanade Ave. It serves marine engineers in New Orleans and Mobile, as well as power and process engineers in eastern La., southern Ark., southern Miss., and southwestern Ala. S G Dukelow, branch manager, is assisted by J M Bevan, service engineer. Schenectady office, formerly a subdivision of New York office, is at 207 State St. It serves power and process engineers in northeastern section of New York State. J F Luhrs is branch manager.

Robert V Salisbury has been made manager of New York branch of **Jenkins Bros.** His headquarters will be in New York offices at 80 White St.

Brown Instrument Co has expanded its sales and service activities in Rocky Mountain area by establishing permanent sales and service representation at 400 Broadway, Denver, Colo., and 437 Atlas Bldg. Salt Lake City, Utah. Donald Larcen has been placed in charge of Denver industrial sales and George Winslow will handle similar duties in Salt Lake City, where he will work with Eldon Richardson, district manager. Areas to be covered by Denver branch will include all Colo., Wyo., and western Neb. Salt Lake City district will cover all of Utah, southern Idaho, and western Nev.

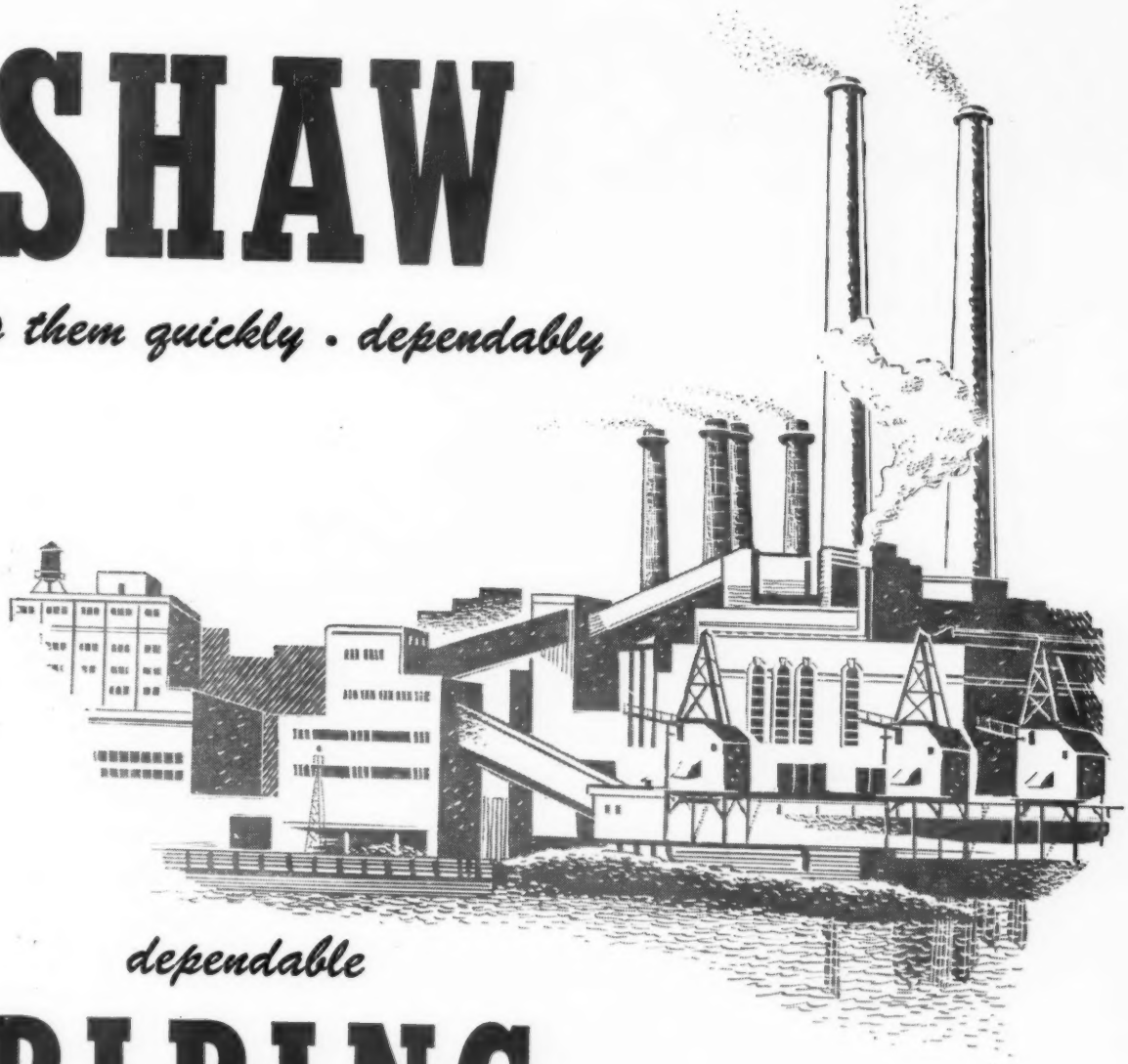
H Merrill Bowman has been named assistant divisional sales manager for power transmission equipment of **Link-Belt Co.** with headquarters at Pershing Rd plant in Chicago. Eugene S Bogart has been appointed district sales manager at Baltimore, succeeding Bowman. Frank C Thompson has retired as purchasing agent for Indianapolis plants. Richard J Joyce has been made purchasing agent for Indianapolis plants, with headquarters at Ewart plant, Indianapolis. Pittsburgh district sales office has been moved to 5020 Centre Ave, Pittsburgh 13. Pittsburgh office is headed by Otto W Werner.

Allis-Chalmers Mfg Co has elected Hugh Comer to board of directors, replacing John H Collier, who resigned because of ill health. W A Roberts and W C Johnson, executive vice-presidents of Allis-Chalmers, have been named to board of

WHATEVER YOUR PIPING NEEDS ★

SHAW

fills them quickly • dependably



dependable

PIPING

pre-fabrication • installation

Benjamin F. Shaw Company is qualified to pre-fabricate and erect piping—any place in the United States and Canada.

President

KNOWN SINCE 1893 FOR HIGH QUALITY

BENJAMIN F. SHAW COMPANY • 2ND & LOMBARD STS. • WILMINGTON, DELAWARE

—and you take a direct route to stepped-up boiler performance, for APEXIOR-coated tube and drum interiors give lasting new-metal service.

APEXIOR NUMBER 1 isolates steel from steam and water contact — permanently stabilizes boiler metal at new or newly cleaned efficiency beneath a surface that's insoluble in any boiler water.

Brush-applied to drums by hand, and to tubes by powercoater, APEXIOR holds the line against operating variables . . . adds a factor of security, for an APEXIORized boiler is corrosion-proof and deposit-resistant — economical to maintain because it stays insulation-free for better heat transfer, longer in-service time, less man-hour cost for cleaning.

Before you order a new boiler, or take an old one off the line, let us tell you more about APEXIORized metal. Write us at 1246 River Street, Hyde Park, Boston 36.

THE DAMPNEY COMPANY OF AMERICA
HYDE PARK, BOSTON 36, MASSACHUSETTS

APEXIOR

43-1-1

directors. Roberts is executive vice-president in charge of tractor div, while Johnson is executive vice-president for general machinery div. New directors succeed late Charles E Albright and Harold S Falk. Falk has submitted his resignation because of weight of other business. E T Cuddeback has been made manager of Tampa district office, succeeding A D Robertson, who resigned. L W Long has become general manager of Boston works. R O Bell succeeds Long as manager of substation section at West Allis. James R Mann has been appointed engineer-in-charge of transformer sales succeeding Bell. Walter L Peterson has been made engineer-in-charge of feeder regulator sales.

Ward C Whippo has been appointed district sales manager for Pittsburgh district of Reading-Pratt & Cady Div of **American Chain & Cable Co,** with headquarters at 908 Empire Bldg, Pittsburgh. Whippo succeeds A W Taggart, who has retired.

Westinghouse Electric Corp has named F D Weatherholt as assistant industrial sales manager, with headquarters at East Pittsburgh. George E Richardson has been made assistant to manager of feeder div.

Major executive promotions and organization changes, affecting sales, production and engineering divisions of **De Laval Steam Turbine Co,** Trenton, N. J., were announced. Under the reorganization, a 5-member executive committee has been created consisting of H L Watson, president, serving as chairman; George C Stoddard, chairman of board; Henry W Johnson, vice-president; C Richard Waller, vice-president; and George W Smith Jr, assistant to president. In executive promotions, J P Stewart has been appointed manager of newly combined commercial and marine sales divisions succeeding H V Petersen, who has retired. H G Bauer, manager of marine div, has been made executive engineer of the company. J W Hertzler, manager of worm gear sales since 1924, has retired and is succeeded by W A Reynolds, who becomes manager of combined IMO rotary pump and worm gear divisions. C A Jurgensen has become acting works manager. W A Neumann is factory controller, assistant treasurer and assistant secretary.

De Laval Separator Co has elected E Gray Merrill vice-president in charge of manufacturing, a newly created office. He retains his position as works manager. T H Walworth has been named treasurer, succeeding Stoddard who has resigned that office. Walworth has continued as comptroller. James E Auston has become secretary, succeeding Walworth. Austin continues as assistant vice-president.

Howard E Degler has been named technical director of **Marley Co,** Kansas City.

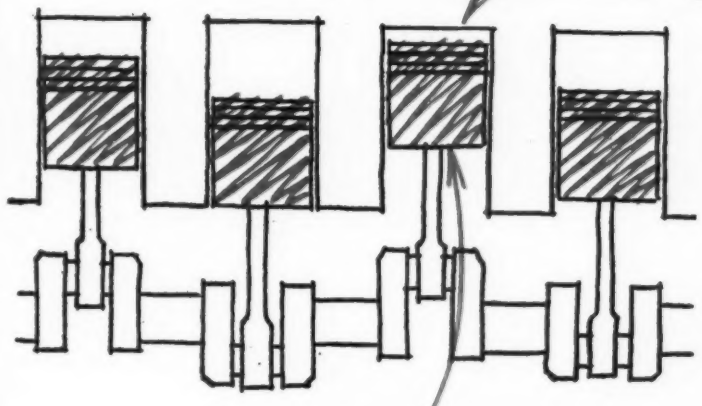
General Electric Co has elected Henry V Erben a vice-president. He also becomes general manager of apparatus dept. Erben succeeds Roy C Muir, who retired. John D Lockton has been named treasurer, succeeding Jesse W Lewis, who retired. F K McCune has been appointed assistant to

LUBE MEMO

Engine overheating caused by stuck rings

Compression loss 30%

400 400 280 400



Hot blowby gases burned piston.

Shop found rings in #2 badly stuck by ordinary oil (blowby has been wasting power).

Foreman claims RPM DELO Diesel Engine Lubricating Oil's compounds will prevent stuck rings 3 ways:

1. Decrease carbon
2. Stop formation of gum.
3. Hold contaminants in suspension (they're flushed out on oil change).

Give shop go ahead on RPM DELO Oil

DIESEL ENGINE RPM DELO LUBRICATING OIL

STANDARD OF CALIFORNIA • San Francisco, Calif.
THE CALIFORNIA COMPANY • Denver, Colo.
THE CALIFORNIA OIL COMPANY • New York
STANDARD OF TEXAS • El Paso, Texas

THE
ALLPAX
GASKET CUTTER

Quickly pays for itself

Made by a packing manufacturer who knows the needs of packing users. This fast, convenient tool will save you time, money and material over the slow laborious sloppy method of cutting gaskets by hand. Gasket cutting is put on a production basis by the "ALLPAX". Cuts clean gaskets in any gasket material in diameters from 1" to 36", with any width flange. Pays for itself and effects savings every time it's used.

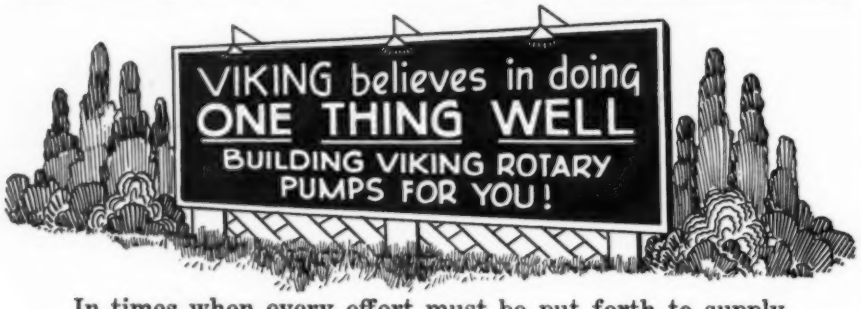
FREE TRIAL OFFER

For a limited time only, we will ship an ALLPAX Gasket Cutter for a 30-day trial at our expense. Write for details of this offer.

Complete . . . ready for use . . . packed in hardwood case with hinged cover. Equipment includes six (6) double-edge cutting blades and one (1) 18" varnished wood cutting board. Order NOW.

PRICE COMPLETE $19.50

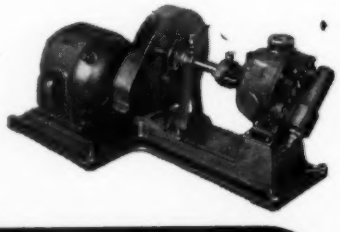
THE ALLPAX CO., INC.
MAMARONECK, N. Y.



In times when every effort must be put forth to supply the unprecedented need for industrial equipment, it is with pride that the Viking Pump Company is able to devote its entire energies to building one product . . . Viking Rotary Pumps.

The present out-put is greater than ever before. Employment is at an all-time high. More new machines are being used to build good, reliable Viking pumps than at any time in the company's history.

We look forward to constantly improving our shipping schedules. Ask for latest delivery information and catalog 47SW today.



See Our Catalog In SWEETS

Viking PUMP COMPANY
Cedar Falls, Iowa

general manager of apparatus dept. Theodore F Nessler has been named to newly created position of purchasing manager for chemical dept. For the time being, Nessler will make his headquarters in Schenectady. Robert L Gibson has been made manager of a newly created personnel div of chemical dept. Gibson will also continue as manager of advertising and sales promotion div. Assisting Gibson will be Everett W Bickford as manager of union relations, George M Hartley as supervisor of planning and preparation, Karl B McEachron Jr as manager of educational activities, and Arthur G Sanford as manager of personnel services and safety. John O Wiley has been made district representative for conduit products in Minneapolis, Minn., area. Samuel Littlejohn has been named manager of Atlantic district of GE upon retirement of W J Dorworth. Littlejohn's headquarters will be in Philadelphia office.

Dowell Inc announces appointment of Chad J Steward as advertising manager.

Wire and cable dept of **U. S. Rubber Co** has named Frederick P Combier as manager of branch sales.

American Potash & Chemical Corp has moved from 609 S Grand Ave to its new executive headquarters building at 3030 W 6th St, Los Angeles 54, Calif. Downtown employment office at 604 S Spring St will be maintained.

Liquid Conditioning Corp, Linden, N. J., announces appointment of Ramon I Gil as representative in Puerto Rico. Gil's headquarters are at 1423 Fernandez Juncos Ave, San Juan 19, Puerto Rico. Tom Charbonneau has been made Florida representative. Charbonneau's headquarters are at 105 S Kentucky Ave, Lakeland, Fla.

T E Hammond has been made district sales agent for **Erie City Iron Works** in Chicago area. His office is at 122 S Michigan Ave. He succeeds C B Acheson, who has retired.

Lincoln Electric Co, has appointed G E Tenney service manager to direct policies and operations of a newly expanded service dept.

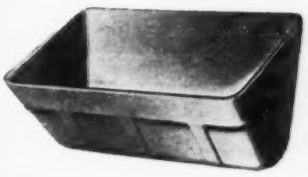
H S Marshall, president of **C A Dunham Co,** Chicago, has announced that a group of Chicago businessmen, including members of Dunham operating and sales organization, have purchased the interests in the company formerly owned by the estate of the late C A Dunham. There will be no change in personnel or policy.

Hammel-Dahl Co, Providence, R. I., has been incorporated to handle properly a greatly increased volume of sales in automatic control field.

Chain Belt Co, Milwaukee, announces election of three vice-presidents: (1) L B McKnight has been made vice-president with executive responsibility for two heavy machinery divisions, conveyor and process equipment and the construction machinery. (2) O W Carpenter has been named a

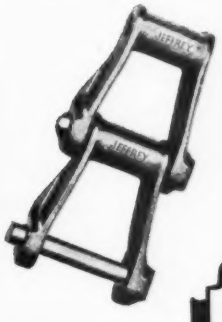
Index of Quality

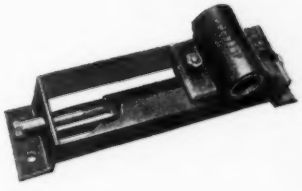
GENUINE



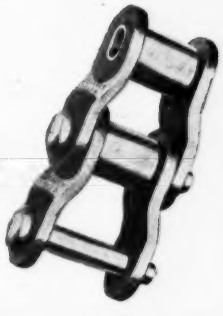
JEFFREY

REPLACEMENT





PARTS



Most standard Jeffrey parts are available when replacement becomes necessary. What's more, they are exact duplicates of original equipment except where Jeffrey improvements from time to time have made them even better. To prevent costly shut-downs and insure longer wear, insist on Jeffrey Replacement Parts.

THE JEFFREY MANUFACTURING COMPANY

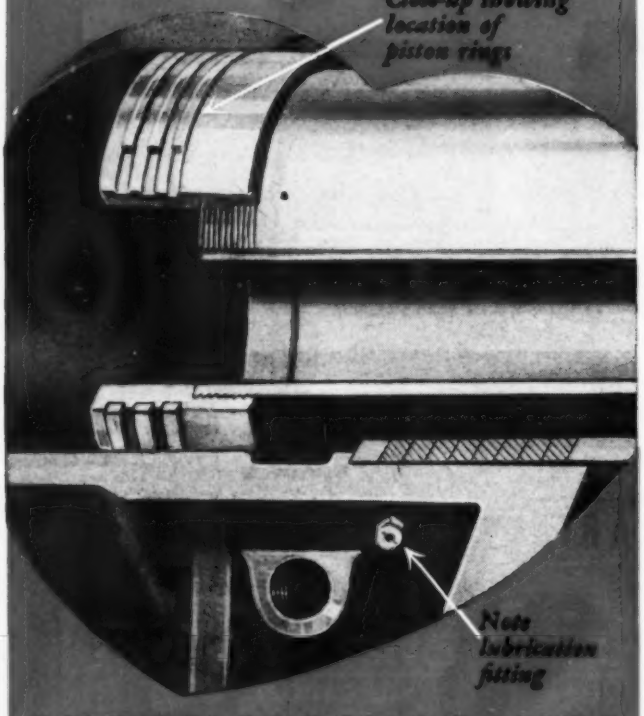
952-99 North Fourth St., Columbus 16, Ohio

ESTABLISHED 1877

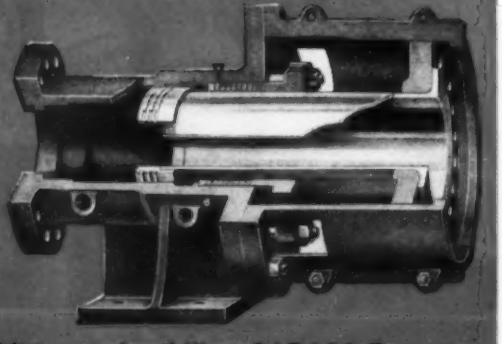
Complete Line of Material Handling, Processing and Mining Equipment

ADSCO

PISTON-RING



EXPANSION JOINTS



In addition to the ability of ADSCO Expansion Joints to handle high pressures and temperatures, piston rings hold the line pressure, making it possible to add packing without shutting down the system. Write for Bulletin 33-15.

AMERICAN DISTRICT STEAM CO.
NORTH TONAWANDA, N.Y.
MAKERS OF UP-TO-DATE STEAM LINE EQUIPMENT FOR OVER 65 YEARS

ADSCO

Representatives in Following Cities

ALABAMA
Birmingham 3-1495
CALIFORNIA
Los Angeles Capitol 5159
San Fran. Exbrook 4000
COLORADO
Denver Keystone 5111
Grand Junction 2242
Pueblo 2085
DIST. OF COLUMBIA
Wash. Republic 6116
GEORGIA
Atlanta Jackson 3696
ILLINOIS
Chicago Central 3434
INDIANA
Indianapolis Riley 1826
IOWA
Cedar Rapids 3-2019
Des Moines 4-3231
KENTUCKY
Louisville Shawnee 9026
LOUISIANA
New Orleans Ray. 7984
MARYLAND
Baltimore Plaza 7334
MASSACHUSETTS
Boston Hubbard 8352
Greenfield 6763
MICHIGAN
Detroit Tyler 7-6322
Kalamazoo 3-2567
MINNESOTA
Duluth Melrose 3394
St. Paul Garfield 5811
MISSISSIPPI
Jackson 4-7689
MISSOURI
Kansas City Har. 1737
St. Louis Forest 0400
NEBRASKA
Omaha Jackson 7636
NEW YORK
N. Y. Penn. 6-0277
Syracuse 2-5678
NORTH CAROLINA
Charlotte 3-7726
NORTH DAKOTA
Fargo 2-2146
NEW MEXICO
Albuquerque 5584
OHIO
Cincinnati Univ. 0422
Cleveland Prospect 4108
Columbus Evergreen 7839
Dayton Fulton 9H4
Middletown 2-6367
OKLAHOMA
Tulsa 4-2908
OREGON
Portland Atwater 3875
PENNSYLVANIA
Phila. Lombard 4900
Pittsburgh Atla. 6083
RHODE ISLAND
Providence Dexter 4700
SOUTH CAROLINA
Greenville 2538
SOUTH DAKOTA
Sioux Falls 5811
TENNESSEE
Knoxville 3-9219
TEXAS
El Paso Main 1787
Houston Hadley 9574
UTAH
Salt Lake City 4-6421
WASHINGTON
Seattle Elliot 4425
WEST VIRGINIA
Charleston 6-7142
WISCONSIN
Milwaukee Kilb. 8210
WYOMING
Casper 1656
ONTARIO, CANADA
Toronto Rand 3166
QUEBEC, CANADA
Montreal Lanc. 1823
HAWAII
Honolulu P.O. Box 2755
PUERTO RICO
San Juan 2-8475

vice-president in charge of finance. (3) B F Devine has become a vice-president and will continue his duties as manager of construction machinery div.

Borg-Warner International Corp has made Albert E Brodigan regional representative in Caribbean area. Brodigan will establish his headquarters at Mexico City. Borge-Warner International will direct export activities of Asbestos Mfg Co, Huntington, Ind.

R B Wilkinson has been elected treasurer of **Graybar Electric Co,** New York City, succeeding E W Shepard, who retired.

Lawrence W Brennan has been elected president of **Brooks Boiler Treatment Co,** Cleveland, Ohio. Other officers elected at the board meeting are: Fred J Mack, vice-president; Alfred B Garson, secretary-treasurer (re-elected); and Larry D Brennan, sales manager.

Boston Gear Works, div of Murray Co, North Quincy, Mass., has appointed James Thomas Chirurg Co, Boston and New York, as its advertising agency. With Chirurg's Boston office in charge, campaign plans are now being formulated in cooperation with Grafton B Parkins, advertising consultant for Boston Gear Works.

Charles P Collins has been elected president and a director of **Norma-Hoffmann Bearings Corp,** Stamford, Conn.

Jefferson Chemical Co, owned jointly by Texas Co and American Cyanamid Co, has announced appointment of J W Holmes as sales manager, with headquarters at 30 Rockefeller Pl, New York, N. Y. Holmes is in charge of sales of commercial products.

A G Schoonmaker, president of **A G Schoonmaker Co,** power machinery firm of New York, has announced appointment of Arthur F Hoffman as comptroller.

John V V Schoonmaker has been named to succeed his late brother, Robert Schoonmaker, as president of **Diesel Motors Corp,** Port Washington, L. I., N. Y.

Dampney Co of America, Hyde Park, Boston 36, Mass., announces appointment of W T Quimby as special representative in New York area for Apexior and Thur-Ma-Lox protective coatings.

To meet demands of increased business, **T. J. Cope, Inc,** has purchased a modern plant at 711 S 50th St, Philadelphia 43, Pa.

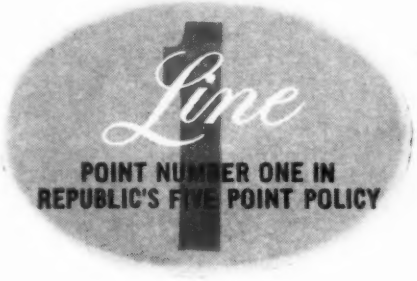
Three changes in personnel of district offices of **SKF Industries, Inc,** are announced: (1) John H Tipton as assistant district manager of Cincinnati office (2) M H Courtenay as assistant district manager of Atlanta office (3) E A Hutson as field engineer in railway sales dept of Chicago office.

R G LeTourneau, Inc, Peoria, Ill., has created a wire rope sales dept as part of the corporation sales div. Direction of

A Distributor serves you Best

Republic's Suction Hose has been designed to meet the requirements of industry everywhere. Whether it be for clear or acid water, whether it be for shell or rock formation, Republic's line is complete.

Expert Information from Your Republic Rubber Distributor is as Near as Your Telephone



A line of rubber items sufficiently complete to permit effectively supplying the requirements of the trade solicited.

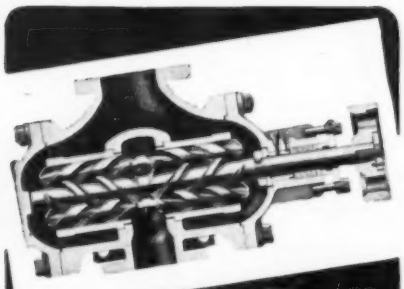
Republic Rubber distributor service is as close to you as your telephone. In addition to his accumulated knowledge, he has Republic's technical men to solve your special problems. Call him for information on any question about the use of mechanical rubber products. Remember please, he also holds large stocks of items in readiness for your emergency and routine needs. Use your Republic distributor service regularly. You'll save.

A QUARTER CENTURY OF PROGRESS

MECHANICAL RUBBER GOODS BY

REPUBLIC RUBBER DIVISION

REPUBLIC RUBBER DIVISION
LEE RUBBER & TIRE CORPORATION . . . YOUNGSTOWN, OHIO
Lee DeLuxe Tires & Tubes, Conshohocken, Pa.



THE IMO PUMP IS RELIABLE BECAUSE IT IS SIMPLE....

The IMO pump has only three moving parts and no valves, timing gears, pistons, cams, vanes or delicate adjustments to get out of order or require maintenance.

IMO pumps have an outstanding record of trouble-free performance in lubrication, hydraulic, governor and fuel oil services.

For further information send for catalog I-135P.

IMO PUMP DIVISION of the DE LAVAL STEAM TURBINE CO. TRENTON 2, NEW JERSEY

Learn the secret

of BIG EARNINGS in . . . . COMBUSTION ENGINEERING

There are plenty of good pay jobs in the power field today. Increase your earnings now—be a Hays-Trained Combustion Engineer. Just a little of your spare time required for the simple, easy-reading Hays Home Study Course. Hundreds of others have made better jobs for themselves through Hays training. So can YOU.

Approved for GI. Write for Free Book Now!

Hays Institute of Combustion
430 N. Michigan Ave., Chicago 11, Ill.
(Dept. 13) Our 28th Consecutive year

HAYS INSTITUTE OF COMBUSTION
430 N. Michigan Ave., Chicago 11, Ill.
(Dept. 13) Please send free book.
Name .....
Address .....
City ..... State .....
Company Name .....

Tournarope sales will be under supervision of W H Wilson, wire rope sales manager. Assisting Wilson will be Michael R Kahle and Alvin J Becker, sales engineers. I F Eckland will be in charge of Tournarope production.

J S Coffin, Jr, Co, Englewood, N. J., has created a separate industrial sales div under Warren A Prest.

General Controls Co has named Don S Bentley as factory branch manager of Los Angeles branch. Bentley will direct his efforts to further company's sales and service in following states: southern Calif., Ariz., sections of Nev., N. M. and Tex. F E Weldon has been made factory branch manager of N. Y. office at 101 Park Ave. General Controls' N. Y. office serves users of automobile controls in N. Y. State, N. J. and Conn. C G McCarthy has been named Detroit factory branch manager. Detroit branch serves users of automatic pressure, temperature and flow controls in Mich., sections of Ohio and Canada.

William T Kelly Jr was elected first vice-president of American Brakeblok div of **American Brake Shoe Co.** In addition to his new duties, he continues as president of Kellogg and engineered castings divisions. John A Fellows has been made assistant chief metallurgist at company's research center at Mahwah, N. J. John P Stevens Jr was named a director of American Brake Shoe Co. J Robert Pauline has been appointed works manager for Kellogg div. In his new position he will continue to be at div headquarters in Rochester, N. Y.

Dearborn Chemical Co, Chicago, has announced appointment of Earl J Goris as advertising manager.

J N Lind has been promoted to assistant general traffic manager of **National Supply Co.** He will make his headquarters in Grant Bldg, Pittsburgh, Pa.

Jeffrey Mfg Co has announced following changes in branch office personnel: (1) Howard S Davies has been transferred to Chicago as district manager, conveyor div. (2) H C Rockwell is replacing Davies as district manager of Baltimore office in Munsey Bldg. (3) Paul M Hendry succeeds Rockwell at Columbus district office. (4) William K Myers succeeds B L Lewis (deceased) as district manager of Boston office at 38 Newbury St. (5) H A Lee has been appointed district manager of St. Louis office at Railway Exchange Bldg. (6) F L Kolb is being transferred to Chicago office in Bell Bldg as district manager, mining div. Following sales engineers have been transferred from home office in Columbus to various district offices as shown: Earl J Woltz to Harlan, Ky.; J R Brisley to Philadelphia; Norman S Bell Jr to New York; and William T Davis to Houston, Tex. J W St. John is being transferred to Cleveland office.

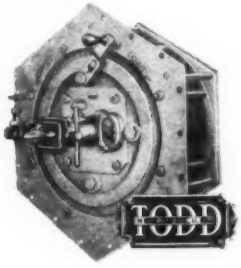
A new div, Robins Engineers, 157 Chambers St, New York City, has been organized by **Hewitt-Robins, Inc,** to handle contracting phases in design, engineering and

OIL ALLOTMENTS GO FURTHER WITH TODD BURNERS

★

● Stretch your oil supply by replacing obsolete equipment with Todd Burners. Avail yourself of the years of experience of Todd engineers.

Oil Burners
Gas Burners
Combination Oil and Gas Burners



COMBUSTION EQUIPMENT DIVISION
TODD SHIPYARDS CORPORATION
81-16 45th Ave., Elmhurst, Queens, N. Y.

NEW YORK • BROOKLYN • ROCHESTER HOBOKEN • NEWARK • PHILADELPHIA HARRISBURG • YORK • CHICAGO • CHARLESTON, S. C. • BOSTON • SPRINGFIELD, MASS. BALTIMORE • WASHINGTON • DETROIT • GRAND RAPIDS • TAMPA • GALVESTON • MOBILE • NEW ORLEANS • LOS ANGELES • SAN FRANCISCO SEATTLE • MONTREAL • TORONTO BARRANQUILLA • BUENOS AIRES • LONDON

PENN SALT

Case Histories

SPECIAL CHEMICALS DIVISION

Date Oct. 9, 1947

Problem BOILER DESCALING with PENNSALT PM-90

Remove hardwater scale from vertical tube, fire tube

ua Plating Company

New York

PM-90 descaling compound

MEMO to Power Engineer: this may be the answer to our boiler cleaning problem J. H. L.

METHOD: To determine scale condition, boiler was filled to operating level with cold water and heated until pressure was established. After four hours 2# steam pressure was attained. Boiler was allowed to cool to 150°F. (water temperature) and, as water capacity was estimated at 150 gallons, two carboys of PENNSALT PM-90 (as supplied) was ~~xyhaust~~ siphoned in through the safety valve outlet. Acid content was checked after all PM-90 had been added and titrations were made at 15 minute intervals until concentration remained constant for 45 minutes. This took 2½ hours.

Boiler was then drained, flushed with water and 13 gallons of an alkaline neutralizing solution (8 oz. gal.) was siphoned into the boiler which was then filled to overflowing with water. After soaking for 30 minutes the alkaline solution, which gave a pH reading of 12.5, was drained.

RESULTS: Examination plug removed at ~~xxx~~ tube sheet level and lights put into boiler. Tubes were completely clean but there was approximately ½ inch of ~~xxx~~ loose ferrous scale on the tube sheet. The boiler was flushed with water refilled to operating level and fired. A pressure of 20# was obtained in 1½ hours starting with cold water. Small quantity of loose scale on the tube sheet was blown down.

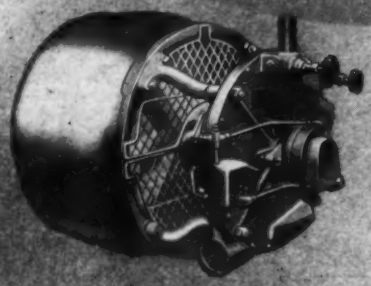
Everyone was very pleased with the job done.

PENNSYLVANIA SALT MANUFACTURING COMPANY

1000 WIDENER BUILDING, PHILADELPHIA 7, PENNA.

If you have a problem in boiler cleaning—we have the products and the know-how to help you descale it quickly and economically. Write to our Special Chemicals Division for further information.

Wing

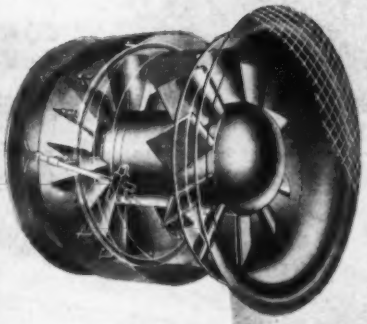


WING TURBINE DRIVEN BLOWERS
Type K
For Brickwall Mounting

Wing pioneered in forced-draft turbine blowers over a third of a century ago. Today Wing Turbine Blowers are in use in thousands of installations in many varied industries. They are simple and rugged in construction, quiet and dependable in operation. Oil-free exhaust can be used for heating, process or feed water.

WING TURBINE DRIVEN BLOWERS
Type R
For Horizontal or Vertical Mounting on Wind Boxes or Air Ducts

Ideal where use can be made of exhaust steam or where electricity is not available. Flexible capacity regulation by throttling steam to turbine—manually by hand valve or automatically by combustion control. Prompt shipments (no waiting for motors).



WING MOTOR DRIVEN BLOWERS
TYPE COM (TWO STAGE)
TYPE EMD (SINGLE STAGE)

Wing Motor Driven Blowers are axial flow forced draft blowers of simple, rugged construction, compact design and highest efficiency. Type EMD has capacities up to 50,000 CFM with statics to 5". Type COM can handle statics up to 30" on special designs.

Write for Bulletin SW-1

L. J. Wing Mfg. Co.
154 W. 14th St., New York 11, N. Y.
Factories: Newark, N. J. and Montreal, Canada

TURBINE BLOWERS • TURBINES • FANS • MOTOR DRIVEN BLOWERS
REVOLVING UNIT HEATERS • UTILITY HEATERS • FIXED DISCHARGE UNIT HEATERS
DUCT FANS • DRAFT INDUCERS • HEATER SECTIONS • SHIP VENTILATORS • FOG ELIMINATORS

installation of complete material handling and processing plants. The 50 engineers assigned to the new div formerly were associated with the concern's Robins conveyors div. Harold Von Thaden heads the new div as vice-president. Elmer C Salzman will be vice-president in charge of sales and R W Eichenberger will be vice-president in charge of the Midwest office in Chicago.

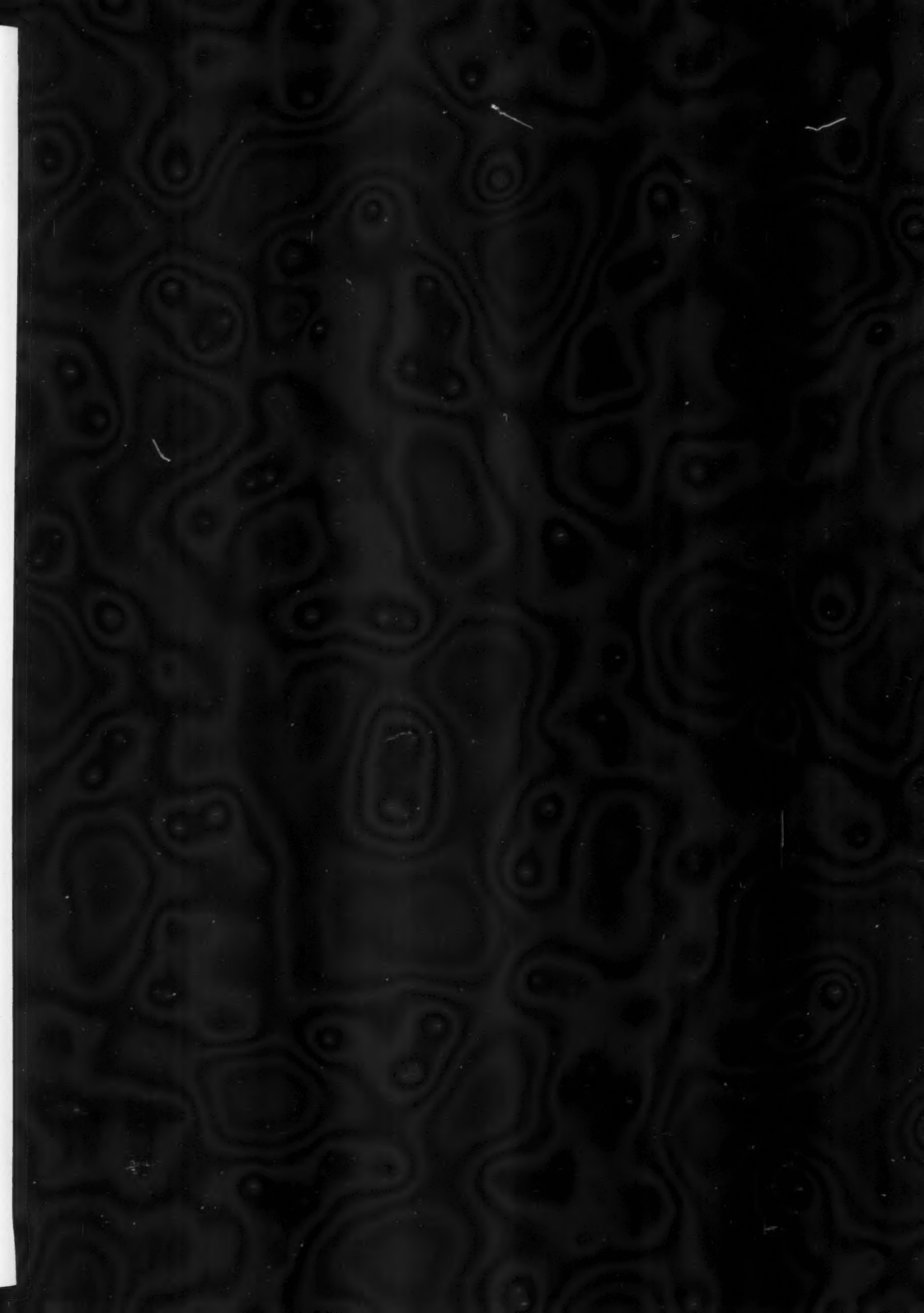
Hewitt-Robins, Inc, has appointed Monarch Electrical Co, LaSalle, Ill., as distributor of entire Hewitt rubber div line of industrial hose, conveyor and transmission belting and packing. Galigher Co, 545 West Eighth South St, Salt Lake City 4, Utah, has been made exclusive representative of Robins conveyors div. Territory includes all of Utah, and parts of Idaho, Mont., Nev. and Wyo. Robins opened a new sales office at Kansas City, Mo. It will be headed by C Boyd Goodhart. As part of a continuing service program to its conveying machinery customers, Hewitt-Robins, Inc, has leased a warehouse at 1010 Pennsylvania Avé, Charleston, W. Va., to step-up deliveries in the industrial South, particularly mining areas of Va., W. Va., Ky., N. C. and S. C. Charleston office of Hewitt-Robins, Inc, including all field service personnel, will be at the above address. Joseph W Wantling is manager of Charleston area for Robins conveyor div and Nelson Reinhold is manager for Hewitt rubber div.

E Putnam Head has been named manager of Atlantic office of **Mason-Neilan Regulator Co,** at 101 Marietta St.

E F Drew & Co, power chemicals div, announces formation of E W Drew & Cia, Argentina, at Buenos Aires, and E F Drew & Cia, Ltda, at Rio de Janeiro, Brazil. Power chemicals div of E F Drew & Co has made following appointments for sale and service of its water-treatment products: (1) J F Bosich, Cleveland, Ohio (2) W H Burr, Chicago, Ill. (3) W J Carlin Jr, New Providence, N J (4) H A Cordt, Milwaukee, Wis. (5) B J Desenberg, Detroit, Mich. (6) P S Laurence Jr, New York, N. Y. (7) I H Longstreet, Philadelphia, Pa. (8) N W McLeod, Hayward, Calif. (9) E F Miller, Boston, Mass. (10) B A Rowe, Torrington, Conn. (11) Warren Douglas Chemical Co, Omaha, Neb. Power chemicals div has taken greatly expanded office and laboratory facilities in London Guarantee Bldg, Chicago, to serve Midwestern customers.

J P Cantor has been made district manager of new Cleveland district office of **Wheelco Instruments Co** at 4501 Prospect Ave. Clarke H Joy, who formerly directed Wheelco sales in this area, has formed the Clarke H Joy Co, specializing in resale of industrial temperature controls and combustion safeguards, including Wheelco products. Herbert Proske has been promoted to assistant district manager of Wheelco New York office. Wheelco Washington, D. C. office has been moved to 2285 Rhode Island Ave. Robert Smith is in charge.

(*Continued on page* 186)



Reader Service Page for . . .

NEW EQUIPMENT and TECHNICAL LITERATURE

Use the handy FREE service cards for additional information on this month's new products or for copies of latest trade catalogs.

NEW PRODUCTS & MATERIALS

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(Turn over for bulletin items)

HOW TO ORDER ADDITIONAL DATA

Be sure to fill out, completely, one coupon for each item of information you order. (See sample, right.) This gives your request authority and helps the manufacturer to address your copy completely.

When you have filled out completely one space for each item of information you want, detach along the scored lines and drop the cards in the mail.

Example

Write here number of item in which you are interested → ET7
Your Company Name Brown Mfg. Co.
Address 3718 First Avenue
Pottsville, Okla.
Your Name John Smith
Your Title Power Engineer
POWER, 330 West 42nd St., New York 18, N. Y.

FILL OUT AND MAIL TODAY! NOT GOOD AFTER JUNE 1, 1948

Write here number of item in which you are interested →
Your Company Name.....
Address.....
.....
Your Name.....
Your Title.....
POWER, 330 West 42nd St., New York 18, N. Y. 3/48

Write here number of item in which you are interested →
Your Company Name.....
Address.....
.....
Your Name.....
Your Title.....
POWER, 330 West 42nd St., New York 18, N. Y. 3/48

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Address.....
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Your Name.....
Your Title.....
POWER, 330 West 42nd St., New York 18, N. Y. 3/48

BOILERS AND AUXILIARIES

1 BURNERS—Peabody Engineering Co., 580 Fifth Avenue, New York, 19, N. Y. Bulletin No. 903 covers M and ML industrial oil and gas burners, showing types, construction features and typical installations.

2 BLOW-DOWN SEPARATOR—Wilson Engrg Corp, 123 South Michigan Ave, Chicago, Ill. 4-page bulletin No. 30 discusses boiler blowdown disposal problems and the Wilson centrifugal blowdown separator.

3 STOKER—Coxe Stoker Engrg Co, Hazleton, Pa. 4-page folder illustrates and describes Hazleton traveling grate stoker for anthracite. Bulletin describes automatic operation and photographs show construction details.

4 OIL BURNERS—Schutte & Koerting Co. 12th & Thompson St, Philadelphia, Pa. 8-page bulletin discusses and illustrates line of mechanical oil burners. Photographs, text and drawings describe the burners, together with general information on construction and operation.

5 WATER COLUMNS AND GAGES—Yarnall-Waring Co, Chestnut Hill, Philadelphia 18, Pa. 20-page bulletin No. WG-1511 explains operation of the Hi-Lo Alarm, construction details of columns, trycocks and gages, column-gage units for pressures over 400 lbs, remote water level indicators and a list of dimensions and prices.

6 REFRACTORIES — Norton Co, Worcester, Mass. 16-page folder illustrates, describes and lists specifications for Norton refractory bricks.

ELECTRICAL EQUIPMENT

7 TIMING MOTORS—Haydon Mfg Co, Torrington, Conn. 16-page catalog No. 320 describes timing motors, timing devices and clock movements produced by Haydon Mfg Co.

8 CONNECTORS — Burndy Engrg Co, New York, 54, N. Y. "Connector Selector", which can also be used as wall chart, is designed to simplify choice of right connector for each job. Terminals, taps, T-connectors and splices indexed for quick selection, and complete ordering information included.

9 TRANSFORMERS — Allis Chalmers Mfg Co, Milwaukee, Wis. 24-page bulletin No. 61B6152A covers construction, operation and application of A-C network transformers. Bulletin also describes how network system operates.

MAINTENANCE AND SAFETY EQUIPMENT

10 TOOLS—Whitman & Barnes Co, Detroit, 16, Mich. New catalog lists and describes company's line of carbide-tipped tools. Also contains information on use and care of these tools, proper speeds, feeds and grinding recommendations.

11 SMALL TOOLS AND PARTS—R Y Ferner Co, 131 State St, Boston 9, Mass. 16-page catalog No. 100C illustrates and discusses small precision instrument screws, nuts and small tools, screw counterbores, drills and saws.

12 TRASH RACKS AND RAKES—Rodney Hunt Machine Co, Orange, Mass. 4-page bulletin No. WCA-146 and a one-sheet bulletin No. WCA-147 describes "Power-Saver" trash racks and hand rakes. The folder is well illustrated and printed in 2 colors.

13 PIPE AND STUD EXTRACTORS—Reps Tool Co, 94 Allyn Street, Hartford 3, Conn. 4-page 2-color bulletin describes Reps' master tool set No. 210 for removing broken pipe and studs of various sizes from ¼ through 2 in. for pipe and ⅜ through 3½ in. for screw and stud sizes.

14 TUBE CLEANERS—Roto Div, Elliott Co, Newark, N. J. 4-page illustrated bulletin No. R 105 10M 12-47 describes complete new line of Rotojet cleaners.

15 TUBE CLEANERS—Thomas C. Wilson Co, 21-11 44th Avenue, Long Island City, N. Y. Wilson catalog No. 76 (48 pages) presents and covers complete Wilson line of tube cleaners. Included in catalog, besides descriptions of regular equipment, is special section devoted to special custom-made cleaners for special problems.

16 FIRE ALARM EQUIPMENT—Autocall Company, Shelby, Ohio. Booklet discusses a complete line of fire alarm, signal and control apparatus.

MAINTENANCE MATERIALS

17 FLOOR RESURFACER — Stonhard Co, 401 North Broad Street, Philadelphia, Pa. Folder describes Stonhard Resurfacer, material for repairs and overlays to concrete and wood floors. Folder lists material characteristics in safety-performance check list.

18 METAL SPRAY—Metallizing Engrg Co, 35-14 36th St, Long Island City, N. Y. Bulletin describes advantages of Metco Sprabond said to be metal that can be sprayed without preparation. Covers three steps needed now (as against eight before) to build up shaft, for example, with metallizing.

19 METAL PROTECTOR — Arco Co, 7301 Bessemer Ave, Cleveland, 4, Ohio. 12-page booklet describes new compound designed to protect exposed metal surfaces from weather hazards on a long-term basis. Bulletin presents data on properties, advantages and typical applications of compound.

20 SAFE WALK COATING—National Engrg Products, Inc, Commerce and Savings Building, Washington 4, D. C. 2-page pamphlet, with illustrations, discusses a slipproof plastic coating for metal, wood and concrete.

21 SEALING & INSULATING COMPOUND—National Engrg Products, Inc, Commerce and Savings Building, Washington 4, D. C. One-page data sheet describes properties and characteristics of Tempseal, a non-burning plastic sealing and insulating compound.

22 CHEMICAL RESISTANT COATINGS—Rust-Oleum Corp, Box 110—FH, 2425 Oakton St, Evanston, Ill. This descriptive bulletin tells of a new chemical resistant coating designed for service under severe acid or alkali fumes, condensates, alcohol fumes, oils, etc.

23 CONCRETE AGGREGATE—Walter Maguire Co, 330 W 42nd St, New York 18, N. Y. 12-page bulletin No. 701 gives recommendations of leading cement

(*Continued on page 178*)

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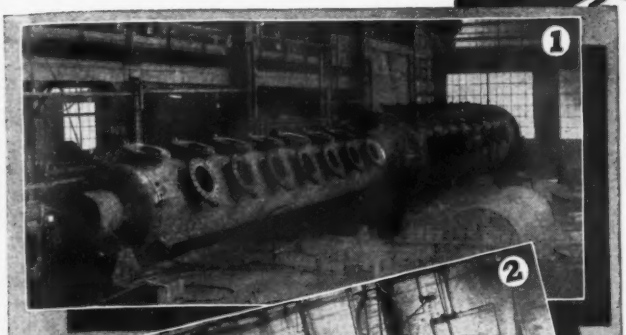
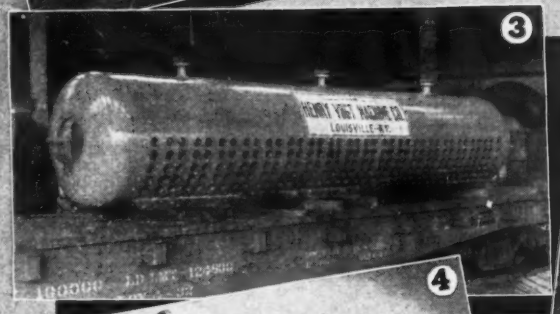
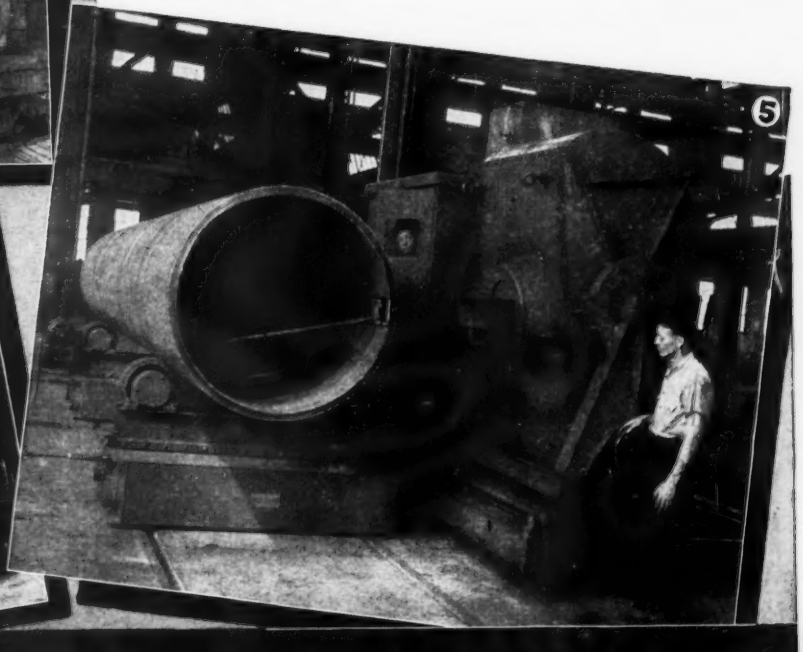
WELDED PRODUCTS by Vogt







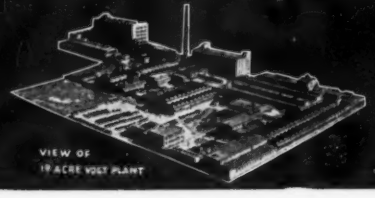
1 - 4′—0″ dia. x 7′—6″ dia. x 82′—5″ high Stabilizer Tower for a Texas Refinery. Fabricated to A.P.I.-A.S.M.E. Code, stress relieved and X-rayed. 250# working pressure.

2 - Heat Exchangers, for an Eastern Refinery, on the testing floor. Units have fusion welded Monel Metal shells and were built to customer's specifications.

3 - 48″ dia. x 22′—6″ long mud drum for a Vogt Water Tube Boiler designed to operate at 450# S.W.P. Fusion welded to A.S.M.E. Boiler Code.

4 - Battery of Absorption Columns in a Western Refinery. Units are 33″ dia. x 41′—0″ high and were stress relieved after welding.

5 - 400 KV Industrial X-ray unit in our plate welding department. Exographs of welded seams can be quickly made because of the special motor operated rolls and traveling carriages which are adjustable to vessels of any size.



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LOUISVILLE, KENTUCKY

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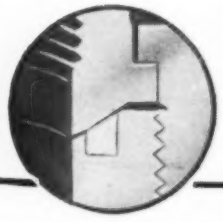
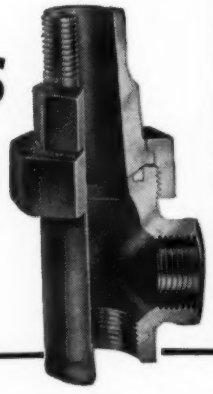
JEFFERSON
Specialty UNIONS
. . . with the
RECESSED BRASS SEAT





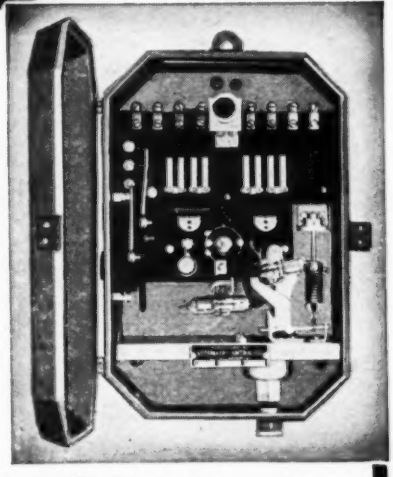
Save Pipe Joints . . . Assure Permanent Tightness

Jefferson Union Tees. . . typical of all Jefferson Specialty Unions in that they save time and expense in piping installation . . . have proved convenient and economical where piping involves a union near a tee. They are available with all-female or male-female threaded pipe ends.
The brass seating, exclusive with Jefferson, is located in a recess away from the runway where it is out of reach of pipe ends no matter how far pipe may be screwed into the fitting. The seating ring is forced into the recess to become practically one piece with the iron. The seating surface is a true ball joint, easily set up for permanent tightness.
Ask for full details . . . through your nearest distributor or through us direct.

Jefferson Union Tee, Male-Female, with union on the run.

JEFFERSON UNION CO.
601 West 26th St. — New York 1, N. Y.
LEXINGTON 73, MASS. — LOCKPORT, N. Y.

Prevent DRY PUMP OPERATION
with the New
AUTOMATIC CONTROL CO.
PROTECTROL



If your primary control calls for pump operation, and water is not discharged —PROTECTROL stops the pump, locks out the starter until PROTECTROL is manually reset. It also rings alarm bell and lights warning signal. It prevents damage to bearings and excessive wear caused by running the pump dry. PROTECTROL can be used with any make of pump or automatic control. PROTECTROL is better than an insurance policy—it prevents damage before it occurs. Write for Bulletin T-1130. State your requirements and engineering data will be furnished.

"AUTOMATIC" also makes pressure and float operated pump controls: multi-circuit sequence type, multi-circuit program type, float switches, automatic alternators, and many special controls built to specifications.

AUTOMATIC CONTROL Company
1009 University Ave., St. Paul 4, Minn.

AUTOMATIC CONTROLS are used by all leading pump manufacturers. When ordering new pumps, specify controls by AUTOMATIC CONTROL CO.

companies and Portland Cement Assn for good aggregate concrete and describes Emeri-Crete flooring made with Cortland emery aggregate.

MATERIALS HANDLING

24 **ELEVATORS**—Otis Elevator Co. 260 Eleventh Ave, New York 1, N. Y. 12-page booklet covers Otis free vertical transportation engineering and planning service, for elevators, escalators and dumbwaiters.

25 **ELEVATOR MACHINE**—Otis Elevator Co, 260 Eleventh Ave, New York 1, N. Y. 4-page, 2-color bulletin No. 27BX describes, with cutaway drawings, how the Otis external geared machine operates. This machine is designed for use with freight elevators that lift heavy loads.

26 **GUIDE CLAMP SAFETY**—Otis Elevator Co, 260 Eleventh Ave, New York 1, N. Y. Bulletin explains operation of Otis flexible guide clamp safety for elevators. This clamp stops the car gradually and automatically if descending speed becomes excessive.

MECHANICAL TRANSMISSION

27 **ROLLER BEARINGS** — Link-Belt Co, 307 N Michigan Ave, Chicago, Ill. "DE" radial-thrust, self-contained preadjusted roller bearings are the subject of 16-page illustrated booklet No. 2196. Booklet contains table of dimensions, weights, bearing capacties at given rpm, shaft fit tolerances, etc.

28 **MECHANICAL TRANSMISSION** — T B Wood's Sons Co, Chambersburg, Pa. 16-page brochure describes and illustrates manufacturing facilities of company in field of mechanical power transmission.

29 **ADJUSTABLE-SPEED DRIVE** — Louis Allis Co, Milwaukee, Wis. Bulletin No. 611C presents "Adjusto-Spede" variable speed-drive. Sectional view of unit shows relationship of parts.

METERS AND INSTRUMENTS, MECHANICAL

30 **MEASURING INSTRUMENTS**—Esterline-Angus Co, Indianapolis, Ind. "Solving Industrial Crimes, No. 34" shows typical examples where use of company's instruments saved time and money. Pictures show applications and installations.

31 **OPERATION RECORDERS**—Esterline-Angus Co, Indianapolis Ind. 16-page bulletin No. 247 contains a factual description of operation recorder, its design features, methods of installation and applications.

32 **FILTER GAGES**—F. W. Dwyer Mfg. Co, 317 S Western Ave, Chicago, Ill. Air filter gages described in bulletin No. 187 are designed to cut down filter resistance, by warning against accumulated dust and dirt.

33 **INDICATORS**—Schutte & Koerting Co, 12th & Thompson St, Philadelphia 22, Pa. 36-page bulletin No. 18-R covers various regulators and special SK Rotameters. Also presents descriptions of several types of SK flow indicators, specific gravity indicators, flow alarms and related equipment.

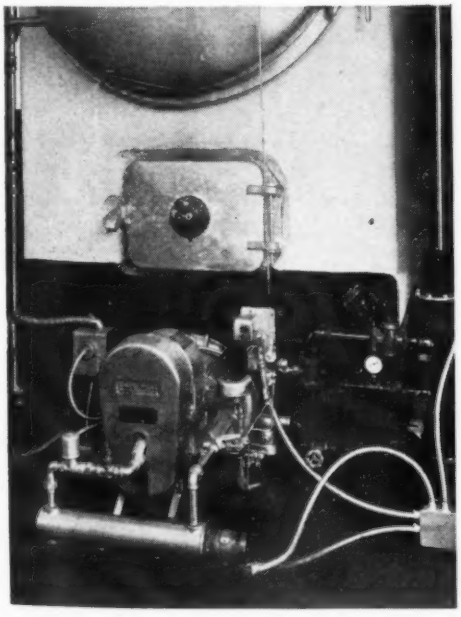
PIPING, FITTINGS VALVES AND SPECIALTIES

34 **WATER STRAINER**—S P Kinney Engineers, Inc, 233 Oliver Ave, Pittsburgh 22, Pa. Many-page booklet describes Brassert automatic self-cleaning strainers, with a number of photographs, operating instructions, and a list of installations.

35 **WELDING FITTINGS** — Taylor Forge & Pipe Works, P O Box 485, Chicago 90, Ill. Pocket-sized folder No. 476 presents Taylor alloy fittings and flanges in easy-to-refer to style.

36 **VALVES**—Edward Valves, Inc, East Chicago, Ind. Catalog section describes forged-steel chrome-molybdenum Intex and Univalves. This catalog gives details of construction, dimensional and design data, material specifications, etc.

Modern ENTERPRISE Gas and Oil Burners provide *Flexible Heating* at *Low Cost* the *Year Round*



This Enterprise Automatic Combination Gas and Oil Burner provides an even temperature the year round, at low cost, to protect the delicate machinery of one of the west's most modern hosiery manufacturing plants. *Enterprise Burner installed by Hess, Greiner & Polland, Los Angeles.*

Among the important considerations to be made in the selection of heating equipment are 1: type and grade of available fuels, 2: comparative fuel costs, and 3: possible future change in either cost or availability of fuel. The decision may easily mean large operating savings—or losses through excessive fuel costs.

Theme Hosiery Co. found the economical answer to their fuel problem a year ago when they installed an Enterprise combination gas and oil burner. This compact, efficient unit permits the immediate use of manufactured or process gas, as well as light or heavy oils—whichever fuel is available at the time for the lowest cost. A fuel selector switch allows instant change-over from gas to oil or vice versa, with no heating shut-down.

This feature of flexibility has long been one of the outstanding merits of Enterprise Burners. Investigate the full line of models and sizes for the best in burners for *your* next installation.

The Choice of Heating Experts—Everywhere

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18th & Florida Streets, San Francisco 10, Calif.
Distributors in Principal Cities

CUT PIPING COSTS

in pressure piping installations!

use either horizontal or vertical!

CATAWISSA VALVES

DOUBLE EXTRA HEAVY UNION SWING CHECK TYPE, HOT FORGED STEEL

Efficient, easily accessible, free-moving flapper gives positive 100% opening in high temperature and extreme high pressure applications!

WORKING STEAM PRESSURE UP TO 600-lbs. (1500-lbs. oil, water or gas).

ELIMINATE additional union and nipple on either outlet or inlet end of line!

WRITE FOR Bulletin 10-A for the complete story!

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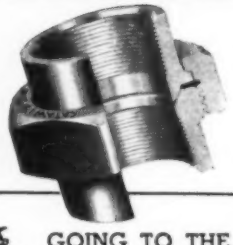

- STANDARD . . . for pressures up to 2000-lbs.
- DOUBLE EXTRA HEAVY . . . for pressures up to 6000-lbs.

GOING TO THE INTERNATIONAL PETROLEUM EXPOSITION IN TULSA, MAY 15 TO 22?

Stop in at Booths 28-29 (Oklahoma Building) and let's get acquainted!

CATAWISSA VALVE & FITTINGS COMPANY
206 Mill Street
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CATAWISSA
UNIONS ★ VALVES

37 **STEAM TRAPS**—Sarco Co, Empire State Bldg, New York, N. Y. Title of this booklet is "How to Select the Right Type of Steam Trap," and the booklet does just that. Illustrated chart permits readers to select, at a glance, right type of steam trap for his particular application. Special features and advantages of each type of company trap are presented.

38 **VALVES** — Parker Appliance Co, 17325 Euclid Ave, Cleveland, Ohio. Catalog No. 301 describes and illustrates valves for industrial hydraulics and fluid handling. Book lists engineering specifications and application data for all types of globe, needle, check, relief, and plug valves made by this company.

39 **BUTTERFLY VALVES** — Henry Pratt Company, 2222 South Halsted, Chicago 8, Ill. A 60-page catalog "A" covers Pratt line of rubber seat butterfly valves and their accessories with actual blueprint reproductions.

PRIME MOVERS AND ACCESSORIES

40 **EJECTORS**—C H Wheeler Mfg Co, Lehigh & Sedgley Ave, Philadelphia, Pa. Catalog No. 1462, 36 pages, covers theory and operating characteristics of steam jet ejectors for all classes of vacuum service.

41 **STEAM TURBINE**—Whiton Machine Co, New London, Conn. 8-page catalog No. ST101 shows in detail many features of company's product. Also includes engineering drawings and dimensional data useful in selecting size and type of turbine needed.

42 **DIESEL ENGINES**—Chicago Pneumatic Tool Co, 6 E 44th St, New York, N. Y. New line of heavy-duty diesel announced in Bulletin 764-2. Features and specifications of both naturally aspirated and Elliott-Buchi Turbocharged engines from 550 to 1650 hp are included.

43 **DIESEL COMBUSTION SYSTEM**—Lanova Corp, 38-15 30th St, Long Island City 1, New York. 58-page booklet discusses, in nontechnical language, fundamental and elementary principles of diesels, their operation, comparison to other types of engines and the Lanova combustion system. The booklet also includes a few useful engineering tables.

44 **AIR FILTER**—American Air Filter Co, Louisville, Ky. 8-page booklet explains operation and application of company's self-cleaning air filter for engine and compressor service.

45 **STEAM TURBINES** — Whiton Machine Co, New London, Conn. A fully illustrated 8-page booklet No. ST101 1147-10 describes this solid rotor type steam turbine in ranges from 5 to 1200 hp.

46 **STEAM TURBINES**—Allis-Chalmers Mfg Co, Milwaukee, Wis. Bulletin, entitled "Standardized Steam Turbine Units," carries illustrations of models in six sizes of standardized units, furnishing data on ratings, pressure and temperature limitations.

47 **PISTON RINGS**—C Lee Cook Mfg Co, Louisville, Ky. 36-page catalog No. 470 fully describes complete line of Cook graphitic iron piston rings for industrial size diesels and compressors.

PUMPS

48 **PUMPS**—Aldrich Pump Co. Allentown, Pa. Data Sheet No. 66 pictures and describes Aldrich inverted vertical triplex pumps. Contains standard ratings, approximate dimensions and diagrams of comparative discharge flows.

49 **CHEMICAL PUMP**—Milton Roy Co, 1305 Mermaid Ave, Philadelphia 18, Pa. 2-page leaflet describes piston-type pump designed to handle liquids in controlled volume, to deliver at a constant rate without pulsations and to pump in quantities as little as 75 ml per hr as a maximum for an individual pump.

50 **CENTRIFUGAL PUMP** — Byron Jackson Co, Los Angeles 54, Calif. 8 page, 2-color bulletin No. 47-8020 describes the Hydroplex pump, a split case multistage centrifugal pump for low-capacity and high-pressure pumping.

Personal History

I come from a large family of problem solvers—the ElectroniK Family. It is traditional in our family to be quick, accurate and sensitive to changing conditions. I am considered not only well balanced, but "Continuous Balance" is my forte—no inching—no nudging—just a smooth, effortless, instantaneous follow-through on temperature changes.

The picture that I have used for this application shows me arrayed as a Precision Indicator, the outfit I use for central reading jobs. But my wardrobe also contains styles for Recording and Controlling—Strip and Circular Chart Recorders—Air and Electric Controllers.

Personal Preferences

None—Will go anywhere—Hot—Cold—Temperate. Day work—night work—or both.

Further Information

Will gladly be forwarded upon request. Thousands of satisfied employers will testify to my versatility.

Brains

CALIBRATED ACCURACY: Normally within ± 1/5% of scale span.

SENSITIVITY: Normally 1/32 of 1% of scale span.

ELECTRONIC "Continuous Balance" SYSTEM: Eliminates manual balancing. Has no galvanometer. Balancing motor and mechanism move only during a change in the measured variable, reducing wear of parts to an absolute minimum. Entire balancing operation is non-cyclic — responds instantly to a change in measured e.m.f.

Brawn

RUGGEDNESS: The few mechanical parts are oversize, making the entire assembly extremely rugged. Neither vibration nor position affects the operation of the instrument.

POSITIVE DRIVE: Scale and slide wire contactor directly connected to balancing motor at all times.

THERMOCOUPLE SWITCHES: Built-in push-button type—self-holding but automatically released upon selection of another point. Number of thermocouple points: 6, 12, 18, 24, 30, 36 or 48.

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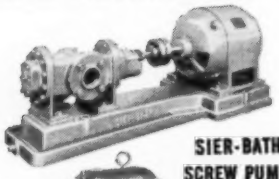
For Lower Cost, More Efficient Pumping
Specify
SIER-BATH ROTARY PUMPS



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SIER-BATH GEAREX PUMP
made by Rotary Pump Specialists

SIER-BATH Screw Pumps and Gearex Pumps are made in a plant keyed to precision methods of gear manufacturing. Our engineers have long experience specializing in the design of rotary pumps. As a result, the high quality of these pumps enables them to operate for long periods without maintenance. Write for detailed information.

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"STANDCO"
PILLOW BLOCKS

There's Extra Value in these rugged well-designed "Standco" Pillow Blocks with their life-long, trouble-free service.

They are fully able to "take it," and have babbitted accurately broached bearing surfaces, with faces machined to a "T". Easy to clean, easy to lubricate.

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SOLD ENTIRELY THROUGH INDUSTRIAL DISTRIBUTORS.

Over 45 Years in Business

STANDARD PRESSED STEEL CO.
JENKINTOWN, PENNA., BOX 577

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St. Louis • San Francisco

Nicholson Expansion Steam Traps are

FREEZE-PROOF

RESISTANT TO TEMPERATURE VARIATION

Pressure: 0 to 250 lbs. without change of valve or seat.
Length: 18" to 40". 2 types: thermostatic, continuous flow.

* Among the features of this simple and widely adaptable trap is its positive action. Closes tight when steam is in trap, opens wide when cold, rendering it freeze-proof. The ease with which it maintains adjustment under extreme variations in surrounding air is another trouble-proof feature.

Easily Installed - Easily Adjusted - Low Cost

Entirely automatic; only one moving part. Adjustable valve for passing condensate at any desired temperature. Low cost, making unit trapping practical. Usually installed without support. Also a complete line of weight and piston operated traps for steam, air, gasoline, pressures to 1500 lbs.; thermostatic steam traps, pressures to 225 lbs. Catalog 444 or see Sweet's.

W. H. NICHOLSON & CO.
125 OREGON STREET, WILKES-BARRE, PA.
Manufacturers of Steam Specialties for Over 75 Years

WELDING

51 GAS WELDING RODS—Page Steel & Wire Div, American Chain & Cable Co, Bridgeport 2, Conn. 3-color, 24-page booklet is devoted exclusively to gas welding wire and its use. It covers application, procedure, proper torch adjustment and physical properties of each gas welding rod.

52 WELDING RODS — Ampco Metal, Inc, 1745 S 38th St., Milwaukee, Wis. Bulletin W-17 contains information on how to weld various alloys using bronze arc-welding electrodes.

53 WELDING EQUIPMENT — Tweco Products Co, P O Box 666, Wichita 1, Kan. 12-page illustrated folder describes electric welding cable connections, including electrode holders, ground clamps, cable connectors, cable splicers, machine terminals, cable lugs and carbon electrode holders. Price list and parts information included.

54 ELECTRODES — Hobart Bros Co, Troy, Ohio. Wall chart shows procedures for every type of arc welding electrode. Shows results of imperfect welding, as well as perfect welds, and cross-sections of all welds.

OTHER EQUIPMENT

55 FANS—Westinghouse Electric Corp, East Pittsburgh, Pa. 8-page booklet covers performance of new line of Axiflo fans for high temperature applications. Characteristics and special advantages of each type listed.

56 VOLTAGE REGULATORS — Allis-Chalmers Mfg Co, Milwaukee 1, Wis. 24-page bulletin No. 01B6056B describes, with many illustrations and color, Allis-Chalmers' self-cooled, 3-phase, 60-cycle feeder voltage regulators.

57 COMPRESSORS—Frick Co, Waynesboro, Pa. Bulletin No. 100-d describes and illustrates "New Eclipse" refrigerating machines. Specifications are included and diagrams show outline dimensions.

58 WATER LEVEL CONTROL—Northern Equipment Company, Erie, Pa. 8-page bulletin No. 475 describes performance and installation of Northern Equipment boiler water-level control at Hammermill Paper Co. Significant data on two boilers are included as well as two sets of boiler water-level charts.

59 DAMPER CONTROL — Cleveland Fuel Equipment Co, 1836 Euclid Ave, Cleveland 15, Ohio. 4-page bulletin discusses Cleveland's new low-cost electric remote damper control, Model DCR-A. It provides, in one compact cabinet, all the elements for safe, automatic control of stack draft.

60 BEARING ALLOYS—Bunting Brass & Bronze Co, 715 Spencer St, Toledo, Ohio. 12-page technical paper presents physical and metallurgical properties of bearing alloys in relation to operating conditions, to assist engineer and designer in selecting proper alloy for given type of service.

61 CARBIDES—Carboloy Company, Inc, Detroit, Mich. 20-page booklet describes organization and history of Carboloy Co, plus a quick picture of "carbides," their manufacture and characteristics.

62 COAL CLEANERS—McNally Pittsburgh Mfg Corp, Pittsburgh, Kan. 20-page bulletin contains information on four coal cleaning systems with explanatory circuits, illustrations of machines and diagrams of operation.

63 CASTING SALVAGE — Eutectic Welding Alloys Corp, 40 Worth St, New York, N. Y. Compact bulletin presents practical procedures for salvaging cast iron, bronze, aluminum and malleable iron castings.

64 COMBUSTION EDUCATION—Hays Institute of Combustion, 430 N Michigan Ave, Chicago 11, Ill. 24-page booklet, entitled "Opportunities for the Combustion Expert" gives a detailed outline of home study course of instruction in combustion engineering.

Here is the CMH answer to expansion joint maintenance problems

CMH Controlled-Flexing Expansion Joints

Sizes 4" to 24" Inside Diameters. For Pressures up to 300 p.s.i. Temperatures to 900° F. Copper or Stainless Steel Pressure Carriers. Traverse from 5/16" to 6-3/4". Flanged or Welding ends. Control Rings Corrugation-mated to close working tolerances.

CMH Free-Flexing Expansion Joints

Sizes 4" to 24" Inside Diameters. For Pressures up to 30 p.s.i. Temperatures to 900°F. Copper or Stainless Steel Pressure Carriers. Flanged or Welding Ends.

Once a CMH Expansion Joint is installed you can forget about it. *There are no maintenance problems . . . there is no maintenance expense.* CMH Expansion Joints are FLEXONICALLY* engineered to give years of dependable service in the control of expansion and the correction of piping misalignment. They are compact units requiring a minimum of space.

CMH Engineered Applications take the guesswork out of expansion joint selection . . . your best assurance of getting the right expansion joint for the job. Write today, for complete details and ask for a copy of Expansion Joint Bulletin EJ-47.

"FLEXON" identifies CMH products, which have served industry for more than 45 years.

*the science of FLEXONICS . . . "the controlled bending of thin metals for use under varying conditions of temperature, pressure, vibration and corrosion" . . . is exemplified in the basic products of Chicago Metal Hose Corporation.

CMH EXPANSION JOINTS

CHICAGO METAL HOSE CORPORATION

Expansion Joint Division • Maywood, Illinois

Plants at Maywood, Elgin and Rock Falls, Illinois

"GUNITE" Concrete

(since 1915)

Linings for

STEEL BUNKERS •
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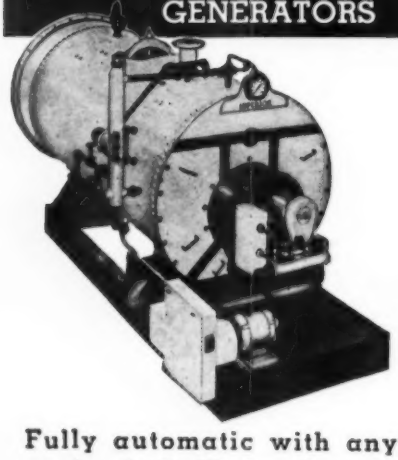
Branch Offices: New Orleans, Dallas, Denver.

SUPERIOR STEAM GENERATORS



Fully automatic with any grade of oil. 17 sizes from 20 to 500 b.h.p. for pressures up to 200 p.s.i. Require no expensive chimney, supply their own induced draft. 80% thermal efficiency guaranteed. Write today for catalog 101.

Superior Combustion Industries, Inc.
Factory: Emmaus, Pa.
Executive Offices: Times Bldg., Times Sq., N. Y.

In a move to maintain current price levels just as long as costs will permit, apparatus dept of General Electric Co has announced a new price-protection policy. It provides for a 20% limitation on price increases, if any, and simultaneously permits the company on new orders to adjust prices within this ceiling to those in effect at time of shipment. The policy covers all orders received Dec 5 and after, and applies to company's apparatus lines, such as motors, generators, switchgear, turbines, controls, power transformers, etc. Many of these product lines still have long backlogs, some up through 1950, and abnormal risks are involved in booking business that far ahead on a firm-price basis. In addition to imposing a ceiling of 20% upon any increases that may later be necessary on account of increasing costs, the new policy gives assurances that any price reductions made will be given immediately to open orders taken under this policy.

Construction of an addition that will double production capacity of New York State Electric & Gas Corp's 40,000-kw Greenidge generating station at Dresden will start in the spring, according to Ralph D Jennison, president. The building program calls for construction of an extension 115 ft long, 155 ft wide and between 90 and 100 ft high at west end of Greenidge station. Installation of the new 40,000-kw turbine-generator will supplement the plant's two 20,000-kw units and increase the station's total generating capacity to 80,000 kw. The new unit was ordered in Jan 1947, with delivery scheduled for Nov 1949. It will go into operation early in 1950.

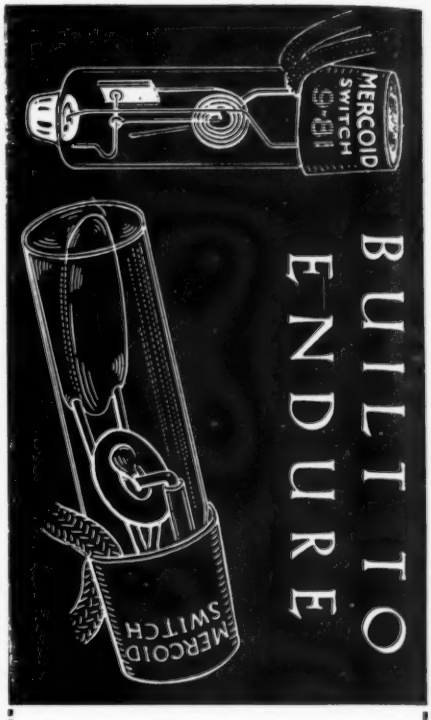
The installation at Greenidge station will include two steam boilers, each capable of producing 288,000 lb per hour at 850 psi and at 900 F. This is an increase in pressure and temperature characteristics over the existing units and will reflect an economy. The design of the completely watercooled furnaces will permit burning all grades of pulverized bituminous coal, which is another economy.

Greenidge station is linked with these company steam-generating plants: 30,000-kw Jennison station at Bainbridge, where plant capacity will be doubled in 1950; 98,750-kw Westover station, near Binghamton; 23,500-kw Riverside station at Elmira and various hydro plants. It also will be connected with the 30,000-kw Hickling steam-generating station now under construction at East Corning.

Gilbert Associates, Inc, Reading, Pa., are the consulting engineers on the construction programs.

Southern Iowa Electric Cooperative, with headquarters in Bloomfield, Iowa, has awarded the contract for a 740-kw power-generating plant to R V Leary & Co, general contracting organization of Des Moines, Iowa.

Ohio State University announces establishment of a dept of welding engineering. In College of Engineering at the university, the new dept will offer undergraduate work leading to degree of Bachelor of Welding Engineering and advanced study for graduate engineers.



MERCURY SWITCHES By MERCOID

Mercury switches are the most advanced means for "making" and "breaking" an electrical circuit. They are not affected by dust, dirt or corrosion and have many definite applications where open contacts are not suitable. Various types available. MERCOID is your guarantee of the best in mercury switches. Further information sent upon request.

THE MERCOID CORPORATION, 4221 BELMONT AVE., CHICAGO 41, ILL.

HERE'S WHAT YOU CAN HAVE *in your* BOILER ROOM · · ·

1. More steam from your present boiler.
2. Less fuel — coal — oil — gas — required.
3. Savings in maintenance whether you have a single boiler or battery of boilers.

HERE'S WHAT DOES THAT JOB FOR YOU · · ·

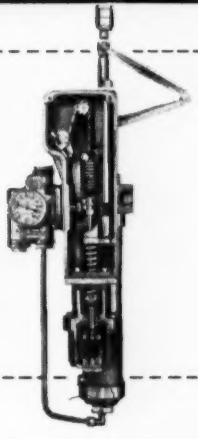
CASH STANDARD
AUTOMATIC COMBUSTION CONTROL SYSTEMS

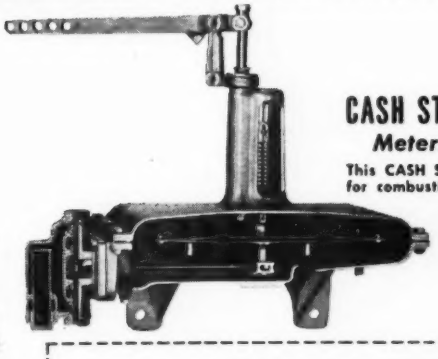
HERE'S HOW IT IS DONE!

CASH STANDARD FUEL FEED CONTROLLER · · ·

Automatically Regulates Fuel Feed

This CASH STANDARD Master Controller automatically regulates fuel feed. Locate it conveniently. Working from boiler pressure, it will adjust the rate of combustion by regulating the rate at which fuel (any kind of fuel) is supplied to the boiler furnace. And it will adjust the Air Flow Controller so the correct amount of air is supplied for proper combustion —hence, money saving.





CASH STANDARD AIR FLOW CONTROLLER · · ·

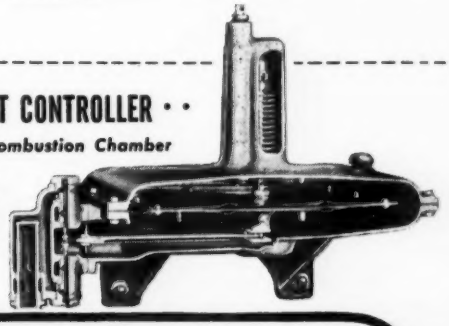
Meters the Air Needed for Combustion

This CASH STANDARD Air Flow Controller meters the air needed for combustion. Install it near its damper. It is not affected by changes in fuel bed resistance or any other variables, because it meters air supply according to the differential pressure through the gas passages of the boiler, doing its part to insure perfect combustion.

CASH STANDARD FURNACE DRAFT CONTROLLER · ·

Maintains a Constant Draft in the Combustion Chamber

This CASH STANDARD Furnace Draft Controller (which comes complete with Operating Power Cylinder) works from overfire draft, regulating the boiler uptake damper to maintain a constant draft in the combustion chamber.



Bulletin No. 300
SHOWS APPLICATIONS ...TELLS HOW THE SYSTEM WORKS IN YOUR FAVOR
Send for it

Tells about Correct fuel feed —Correct fuel-air ratio — Correct over-fire draft and how you get all three. It shows applications and how various CASH STANDARD Units can be made to meet any specific condition and work on any boiler or stoker with any kind of fuel.

A. W. CASH COMPANY
DECATUR, ILLINOIS

CASH STANDARD
CONTROLS . . VALVES

Standard for Safety!

Above—No. 101

Left—No. 102

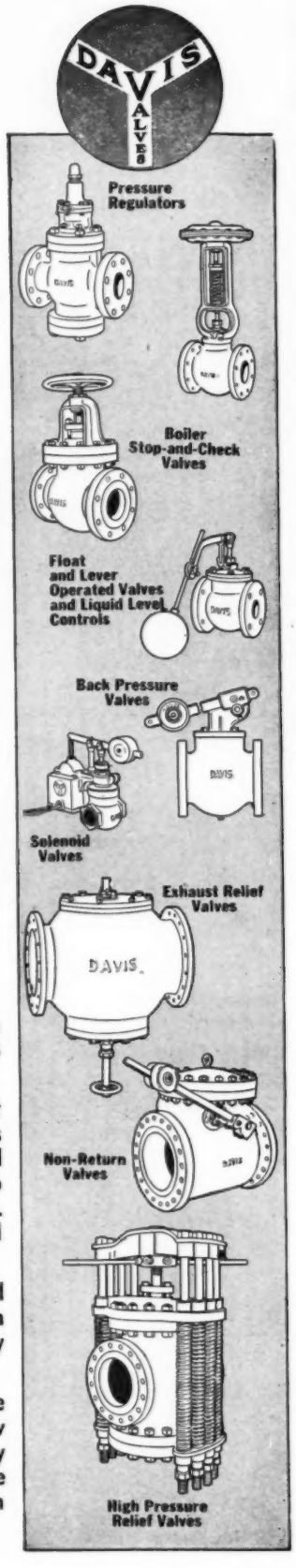
DAVIS BOILER
STOP and CHECK
VALVES

● Davis Stop-and-Check Valves have long been "Standard for Safety" in boiler plants throughout the nation.

NO. 101—Designed particularly for finest high pressure, heavy duty steam plants. Features an external oil dash pot and counter-weighted lever which can be moved by hand at any time to test the valve and also provides visible action. Inside, it is as clean and simple as a streamlined globe valve.

NO. 102—The popular valve for general service. Features an ingenious valve design with internal steam dash pot eliminating any tendency to chatter.

BOTH TYPES are available in a complete range of sizes. Globe, angle, corner or elbow body patterns. Semi-steel, carbon steel, or alloy steel bodies, with suitable trim for any pressure and temperature. For prompt service, send an outline of your requirements.



DAVIS REGULATOR CO.

Representatives in All Principal Cities

2540 S. WASHTENAW AVE., CHICAGO 8, ILL.

Appointments

(*Continued from page* 176)

Monsanto Chemical Co has announced appointment of Edwin L Hobson as sales manager of thermoplastic molding materials. Hobson replaces Arnold C Martinelli, who resigned to become general manager of Rogers Plastics, Inc, North Wilbraham, Mass. James P Skehan replaces Hobson as assistant branch manager for New York plastics office. Sheet dept will be combined with packaging materials dept under direction of Richard C Evans. Assisting Evans as assistant sales managers will be James Brunner, in charge of packaging materials sales, and Oscar E Hollemans, sheet sales.

G V Slottman has been made technical assistant to the vice-president of **Air Reduction Sales Co.** Scott D Baumer succeeds him as manager of technical sales div. Edward H Roper was appointed assistant manager of that div. Charles S Munson, formerly president of Air Reduction Co, has been elected chairman of executive committee. He is succeeded by John A Hill, who becomes the fifth president. William C Keeley was made chairman of finance committee.

Air Reduction Co has formed a new, wholly owned subsidiary, the Air Reduction Pacific Co. It will carry on all the business formerly conducted by Air Reduction Sales Co in western region of the U. S., including San Francisco, Los Angeles, Portland, Seattle sales districts.

H P Etter will be president and director of **Air Reduction Pacific Co.** The other directors will be C D'W Gibson, G E Hawkins, J A Hill, C G Andrew and W C Keeley, who will also serve as chairman of board.

Theo C Ulmer, Inc, is the new authorized distributor for **Carboloy Co.** Headquarters office and salesroom will be maintained in Philadelphia. In addition to Philadelphia and the metropolitan area, Theo C Ulmer, Inc, will also supply users in southeastern Pa., southern N. J. and northern Del. Robert S Scott, sales manager at Ulmer, will head up new Carboloy operation.

Public Service Electric and Gas Co has named Herbert Wottrich assistant to general manager, electric dept. Hervey S Vassar has retired as laboratory engineer.

Fred Spaulding has taken over position of manager of Colfax district of **Iowa Power and Light Co,** succeeding A D Carlson. Carlson has been named manager of Oskaloosa district.

Narragansett Electric Co, Providence, R. I., has elected William W Broadbent vice-president in charge of production.

New resident managers for Schenectady and Troy districts of **New York Power & Light Corp** have been appointed: Lay-

TESTS GIVE RUBBER A GOOD GRIP ON LIFE

The tight adhesion of rubber-to-fabric is an important factor in the long-lasting quality of belting, hose, packings. That's why Quaker technicians are constantly making adhesion tests after samples of rubber and fabric are "welded" by miniature calenders shown above, to assure a tight union.

This is only one of eighteen rigid tests that raw materials and finished products *must* pass before receiving the Quaker stamp of approval. Yes—pre-testing provides quality and long service . . . assures worthwhile dividends for you through higher plant efficiency, lower operating costs.

Call your nearest Quaker distributor for speedy service. He and the Quaker sales engineer are teamed to provide accurate recommendations on Quaker pre-tested belting, hose, packings.

QUAKER RUBBER CORPORATION

PHILADELPHIA 24, PA. • New York 7 • Cleveland 15 • Chicago 16 • Houston 1

Western Territory

QUAKER PACIFIC RUBBER CO. • San Francisco 5 • Los Angeles 21 • Seattle 4

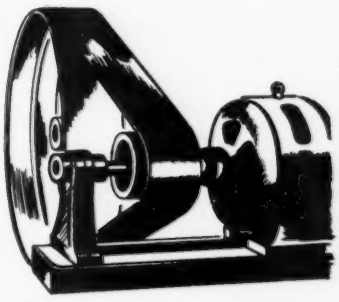
QUAKER RUBBER CORPORATION PHILADELPHIA PA. QUALITY SINCE 1899 REG. U. S. PAT. OFF.

QUAKER RUBBER PRODUCTS

custom made for every industrial use

PRE-TESTING PAYS OFF WITH PEAK SERVICE

Check these pre-tested and proved Quaker products that help reduce operating costs for industries everywhere.

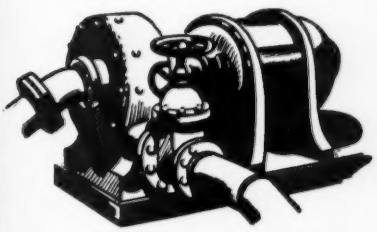


MORE POWER FOR PRODUCTION

In the complete line of Quaker transmission belts and belting pre-testing plays a vital part in providing long service, tight grip, slip-less power. Both V and flat types . . . transmission and conveyor, for all purposes.

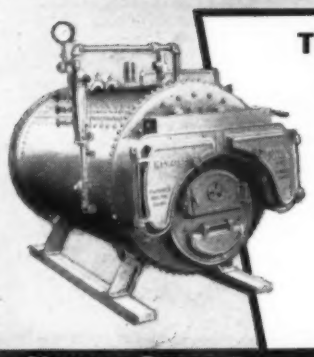
STANDS PRESSURE, RESISTS WEAR

Quaker hose, in moulded and wrapped construction, is ruggedly built of pre-tested materials for trouble-free transmission of air, steam, water, acids, volatiles. Tight adhesion of rubber and fabric resists pressure, twisting, severe wear.



STOPS LEAKS . . . CUTS COSTS

Quaker pre-tested packings for all purposes stop hot leaks cold . . . provide tight-sealing, long lasting service for valves, piston rods, flanges. Ideal for packing against steam, water, acids, volatiles. Call Quaker for solution to your packing problems.



TROUBLE-FREE

KEWANEE

SCOTTIE JR

• It lasts and lasts and lasts without break-downs. Easy to handle, every part accessible . . . *it's truly trouble-free.* For any fuel

6 to 30 H. P.—100 lbs. W. P.

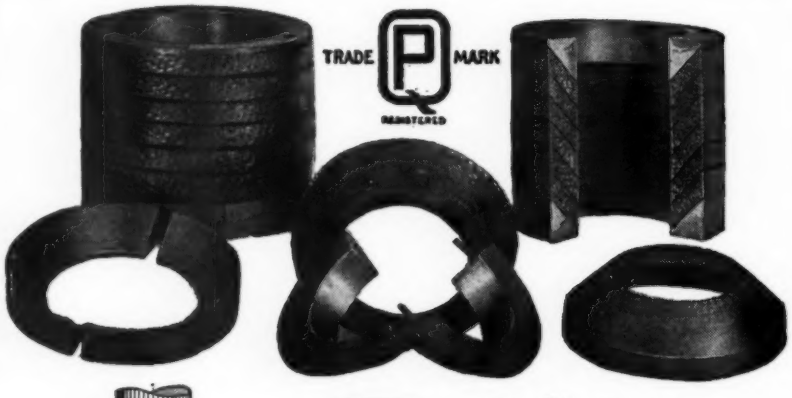
For 6" Scale with pipe diameter markings—WRITE Dept. 99. -K3

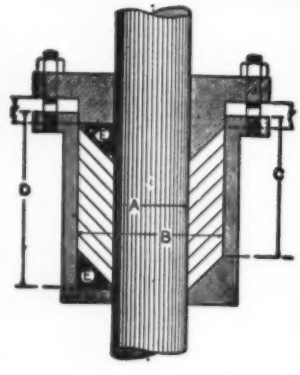
KEWANEE BOILER CORPORATION
KEWANEE, ILLINOIS

Diesel Engines

A SPECIAL SECTION

In its April issue, POWER will commemorate the 50th Anniversary of the American diesel engine with a comprehensive survey of modern engines. Watch For It!





Self-Setting

PACKING

Tested and approved under the most grueling operating conditions, Q-P Self-Setting Packing meets the most rigid standards of maintenance economy. Exceptional performance features make Q-P Packing ideal for use in valves, turbines, diesels, expansion joints, hydraulic equipment, etc., where superheated steam, saturated steam, hot or cold water, ammonia, fuel oil, compressed gasses, acids, etc., are present.

Put your packing problem in our hands—no obligation. Write, wire or phone today.

THE Q-P MANUFACTURING COMPANY
NEEDHAM HEIGHTS 94, MASS.

Sales Representatives in Leading Cities from Coast to Coast

don Lansing succeeds George J Helling at Schenectady. Helling retired after 41 years' service. Leonard F Mayer succeeds George Matthews at Troy.

Cleveland Electric Illuminating Co has appointed R C Hienton industrial sales manager. Hienton will continue to direct company's development div. H A Lawrence has been named commercial sales manager.

Harold A Noble has been made general superintendent of **San Diego Gas & Electric Co.**

James A Bullock, general manager of **Western Colorado Power Co** since 1937, has been promoted to vice-president.

Arizona Edison Co has named Reid Gardner president. He succeeds the late Phillips B Shaw. Douglas B McGregor has been elected executive vice-president.

N H Callard has been made manager of **Hilo Electric Light Co,** Hilo, Hawaii.

James C Littlefield has been promoted to manager of Salt Lake div, **Utah Power & Light Co,** succeeding C W Wolfrom, who retired.

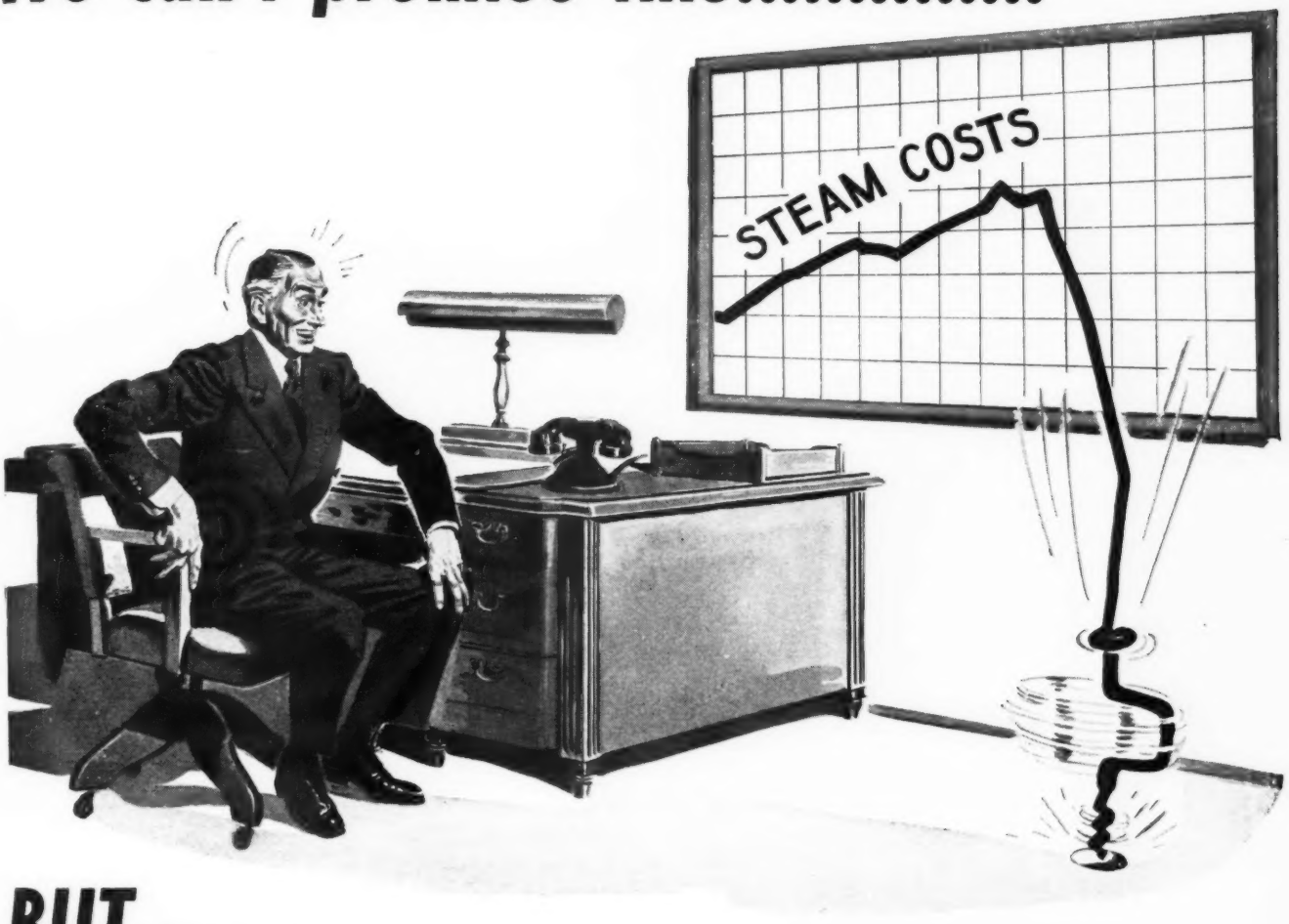
Foundation Co, New York 5, N. Y., has appointed Wilbur S Cooper chief industrial engineer in charge of its industrial and central power-plant projects.

Kenneth R MacKinnon has been elected president of **Ebasco International Corp.** New York City, engineers and developers of foreign power projects.

Eutectic Welding Alloys Corp, New York City, has appointed Theodore I Leston as vice-president in charge of production.

Donald C Luce has been elected vice-president in charge of electric operation and Watson F Tait Jr has been appointed general manager of electric dept, **Public Service Electric and Gas Co,** Newark, N. J. Luce and Blake were elected members of boards of directors of Public Service Electric and Gas Co and Public Service transportation companies. Blake is general solicitor of these companies. Lyle McDonald, who was made vice-president in charge of finance, and Jacob T Barron, who was recently named vice-president in charge of combined operations, Public Service Corp of N. J., were elected to the same posts, respectively, in Public Service Electric and Gas Co and Public Service transportation companies. Joseph T Foster was appointed a member of executive committee of Public Service Electric and Gas Co and Public Service transportation companies. Foster is vice-president in charge of real estate and purchases for these companies. Franklyn Heydecke was made comptroller and F Warren Cooper assistant comptroller of Public Service Electric and Gas Co. They were appointed to the same posts, respectively, in the corporation. In the Public Service transportation companies the following changes

We can't promise this.....



BUT.....

We *can* promise you low steam costs. Savings of as much as 20% can often be realized by replacing a conventional 14-year old boiler with a modern Preferred Unit Steam Generator.

WHY? Because the Preferred packaged power plant is the *only* factory-completed unit steam generator with *all* these money-saving features:

1. Induced (Pull-through) Draft. A distinctive feature which eliminates the necessity of building costly stacks. Only a simple vent to the outside air required. No escape of products of combustion into the boiler room.

2. Fully Automatic Operation, even with Bunker C, No. 6, including the new catalytic residuals.

3. Preferred Oil Burner, built especially for this unit.

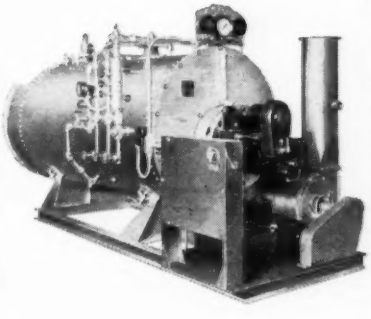
4. Four-Pass Gas Travel results in maximum heat absorption.

5. 80% Thermal Efficiency proved and guaranteed.

6. Low Maintenance, the result of over 27 years of combustion engineering experience.

7. Full Range of Sizes from 40 to 500 hp. and pressures up to 200 lbs. Two-Pass Units in 10, 20, 30 hp. and pressures up to 125 lbs.

These features add up to lower fuel costs, minimum repair bills and the elimination of costly, unexpected shutdowns for those who replace their old boiler with a modern Preferred Unit Steam Generator.



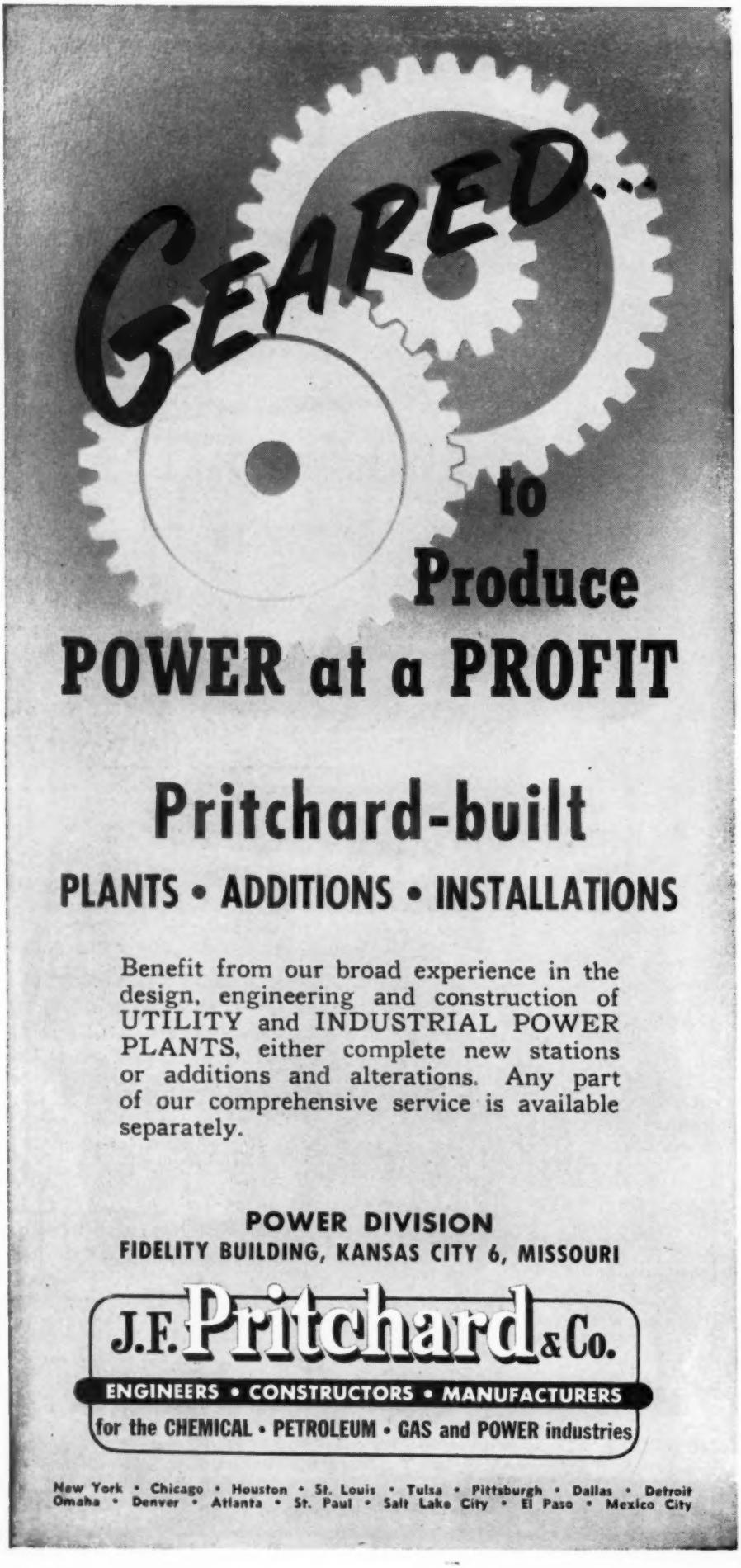
Two Booklets giving the inside story on Preferred steam generation are yours for the asking. *"Dividends From Your Power Plant"* tells the "profit side" of the story in 36 fact-filled pages written especially for management. Bulletin 1000E gives the *engineering* details on these money-saving units.

Send for your copies, today!

P-3-48

PREFERRED UTILITIES MANUFACTURING CORP. 1860 Broadway, New York 23, N. Y.

PREFERRED UTILITIES MFG. CORP.


GEARED...
to
Produce
POWER at a PROFIT
Pritchard-built
PLANTS • ADDITIONS • INSTALLATIONS
Benefit from our broad experience in the design, engineering and construction of UTILITY and INDUSTRIAL POWER PLANTS, either complete new stations or additions and alterations. Any part of our comprehensive service is available separately.
POWER DIVISION
FIDELITY BUILDING, KANSAS CITY 6, MISSOURI
J.F. Pritchard & Co.
ENGINEERS • CONSTRUCTORS • MANUFACTURERS
for the CHEMICAL • PETROLEUM • GAS and POWER industries
New York • Chicago • Houston • St. Louis • Tulsa • Pittsburgh • Dallas • Detroit
Omaha • Denver • Atlanta • St. Paul • Salt Lake City • El Paso • Mexico City

were made: (1) Edward A Tuson was appointed comptroller. (2) C Fred Rogge was made assistant comptroller.

Stone & Webster, Inc, has acquired E B Badger & Sons Co for purpose of expanding engineering and construction activities of its subsidiary, Stone & Webster Engrg Corp, in process and industrial fields.

M W Kellogg Co, process engineers, announces appointment of Dr W E Hanford to newly created post of director of petroleum and chemical research.

Robert H Fuller has joined **H K Ferguson Co,** industrial engineers and builders, as a contract engineer in Eastern district.

Frederick V Armistead and Dwight J Goodman have formed the consulting engineering firm of **Armistead & Goodman** at 1259 N Kingshighway Blvd, St. Louis. They will specialize in industrial and municipal engineering.

Gates, Moe and Weiss, consulting engineers of Milwaukee, Wis., announce that R O Papenthien, architect and engineer, is now associated with their organization.

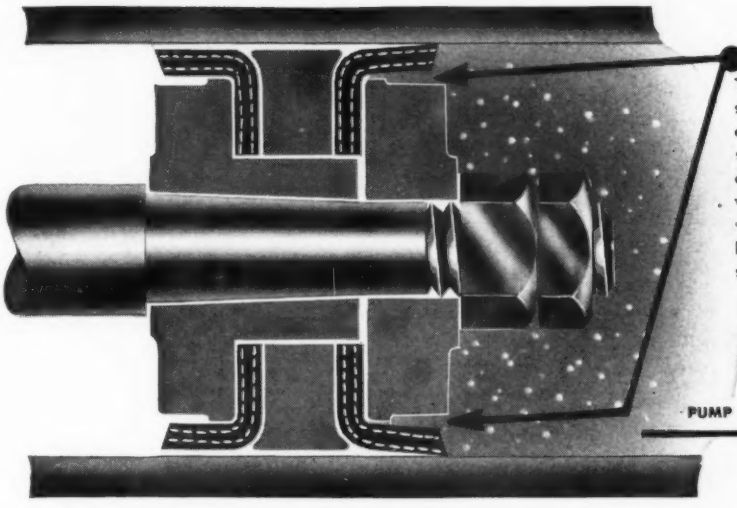
Everett Morss, president of Simplex Wire and Cable Co, has been elected to board of directors of **Arthur D Little, Inc,** Cambridge, Mass. Morss replaces W Cameron Forbes, who resigned. Officers of Arthur D Little, Inc, for 1948 will be Earl P Stevenson, president; Raymond Stevens, Thorne L Wheeler and Leroy F Marek, vice-presidents; Henry G Powning, treasurer; and Frank N Houghton, secretary.

Pioneer Service & Engrg Co, Chicago, announces that it has acquired the business and personnel of Public Utility Engrg & Service Corp.

Dr Oleg Yadoff has been appointed research associate in civil engineering at **Columbia University.** He will be associated with Prof Boris Bakhmeteff, specialist in fluid dynamics, and will continue research on projects involving measurement of low fluid velocities and turbulence.

Carnegie Institute of Technology has named Dr J C Warner assistant director of College of Engineering and Science. Dr Warner will continue as head of chemistry dept and dean of graduate studies.

Six changes in administrative positions at **Cornell University** were announced: (1) Dr Arthur S Adams, provost, resigned to become president of University of New Hampshire as successor to Dr Harold W Stoke, now president of Louisiana State University. (2) Robert A Doyle, vice-president for university development, has also resigned, but will continue on the staff as a voluntary special assistant to President Edmund E Day. (3) Theodore P Wright has been appointed president of Cornell Research Foundation and a vice-president of the university. (4) George F Rogalsky has been made vice-president



This greatly exaggerated diagram shows the Darcova Pumcup principle. On pressure side of each piston stroke, flexible Pumcup is automatically forced against liner or cylinder wall. Firm, uniform contact all the way around eliminates slippage, holds volumetric efficiency at constant high in spite of gradual wear.

PUMP PISTON MOTION

THEY NEVER RELAX
when the pressure is on!

HERE is a piston packing that actually takes *advantage* of the fluid pressure built up in reciprocating pumps and in air or hydraulic mechanisms. The illustration above shows how Darcova Pumcups utilize this pressure . . . how they hug the cylinder wall on every work-stroke of the piston, preventing needless slippage.

Then, too, friction between the Pumcup and cylinder is automatically "pressure-equalized" all the way around for a uniformity of wear otherwise impossible. And, in contrast to other types of packing, fluid slippage does not increase with wear. Peak volumetric efficiency is retained even when Pumcup wear is far advanced.

Consequently, Pumcups offer two mighty important advantages. First, downtime and material and maintenance costs are cut to a fraction because Pumcups outlast other types of packing many times over. Secondly, volumetric efficiency is held constant.

Everything considered, it is easy to see how thousands of Darcova Pumcup users are saving up to $100 per pump per year. Easily installed, Pumcups replace ordinary packing in reciprocating pumps and in air or hydraulic mechanisms. They are precision built in ½ to 42 inch sizes and in many different textures for practically all fluids, pressures and temperatures.

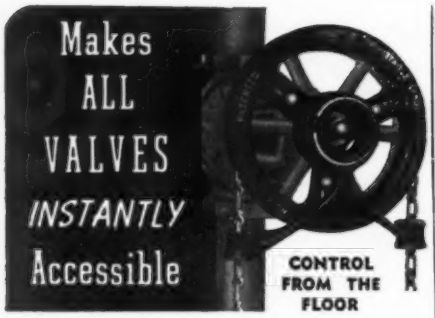
DARCOVA
THE ORIGINAL COMPOSITION CUP

***FREE BULLETIN**—For a free bulletin containing complete information, write, or use the coupon below.*

DARLING VALVE & Manufacturing Co.
WILLIAMSPORT, PA.

Darling Valve & Mfg. Co., Williamsport 61, Pa.
Please send me the free bulletin checked below:
☐ No. 4401 Darcova Pumcups for reciprocating pumps.
☐ No. 4502 Darcova Pumcups for air or hydraulic mechanisms.

Name_____
Company_____
Address_____
City_____ State_____



● Instant, handy, safe control of overhead and other out-of-reach valves. Eliminate danger to employees; banish the stepladder. Now — install valves anywhere they should be, regardless of accessibility.

Inexpensive BABBITT Sprocket Rims fit all types and makes of valves, with either rising or non-rising stems. Installed quickly by clamping directly onto hand wheel of valve. Eliminates makeshift apparatus and specially-made chain wheels.

● Ten standard sizes take care of all valve wheels from 2 to 30 inches in diameter.

● *Request Catalog Bulletin P, prices, name of local distributor:*

Babbitt
Adjustable
SPROCKET RIM
with Chain Guide

BABBITT STEAM SPECIALTY COMPANY
Manufacturers of Adjustable Valve Operating Mechanisms
New Bedford, Mass., U.S.A.

Diesel Engines

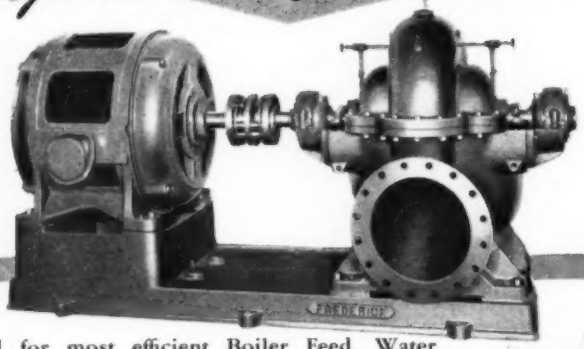
A SPECIAL SECTION

In its April issue POWER will commemorate the 50th Anniversary of the American diesel engine with a comprehensive survey of modern engines.

Watch For It!

FREDERICK CENTRIFUGAL PUMPS

Engineered to fit your job!



Designed for most efficient Boiler Feed, Water Works, Circulation, Drainage or General Service . . . Capacities up to 20,000 G.P.M. . . . Heads up to 600 P.S.I. . . . Open, Splash proof or totally enclosed ball bearing motors and steam turbine drive . . . In constant use today by many leading power plants.

Frederick
ESTABLISHED 1890
IRON AND STEEL, INC.
Pump Division — Frederick 4, Md.
REPRESENTATIVES IN PRINCIPAL CITIES

—Send for these attractive, colorful booklets which give details of construction and operation of Frederick Pumps. They'll show you how Frederick Pumps are engineered to fit your job. Ask for Bulletins 103 & 104.

ALSO MANUFACTURERS OF FRECUT AND FREFORM METALWORKING MACHINERY, FREDERICK STOKERS AND ASH CONVEYORS AND A COMPLETE LINE OF GRAY IRON CASTINGS.

—business under a new alignment of the university's business and financial operations. (5) Lewis H Durland has been named treasurer to assume financial responsibilities formerly held by Rogalsky. (6) Raymond F Howes has been made secretary.

National Electrical Manufacturers Assn has elected three Cutler-Hammer men to NEMA chairmanships for the coming year. F A Wright, Cutler-Hammer assistant general sales manager, was made chairman of advisory committee, industrial control section. A R Johnson, Cutler-Hammer manager of merchandising sales, was elected chairman of knife and enclosed switch section. R A Millermaster, Cutler-Hammer assistant manager of development, has been named chairman of general engineering committee of knife and enclosed switch section. He also has been appointed chairman of general engineering committee, small air circuit breaker section.

Louisiana Engrg Society has installed following engineers for 1948: W Stone Leake, president; H L Lehmann, first vice-president; L J Cucullu, second vice-president; and John P Fernandez, secretary-treasurer.

Brady-Parkinson Co, an advertising, marketing, and business consultation firm, announces that it has changed its name to **Richard H Brady Co.** Executive offices are at Stevens Point, Wis. Other offices are in Appleton and Wausau.

John Gilbert Craig, Inc, advertising, has announced removal of its offices to 913 Washington St, Wilmington, Del.

OBITUARIES

James G Biddle, 79, a Philadelphia pioneer in the field of measuring instruments, and founder and chairman of board of directors of James G Biddle Co, died on Dec 21 after a brief illness.

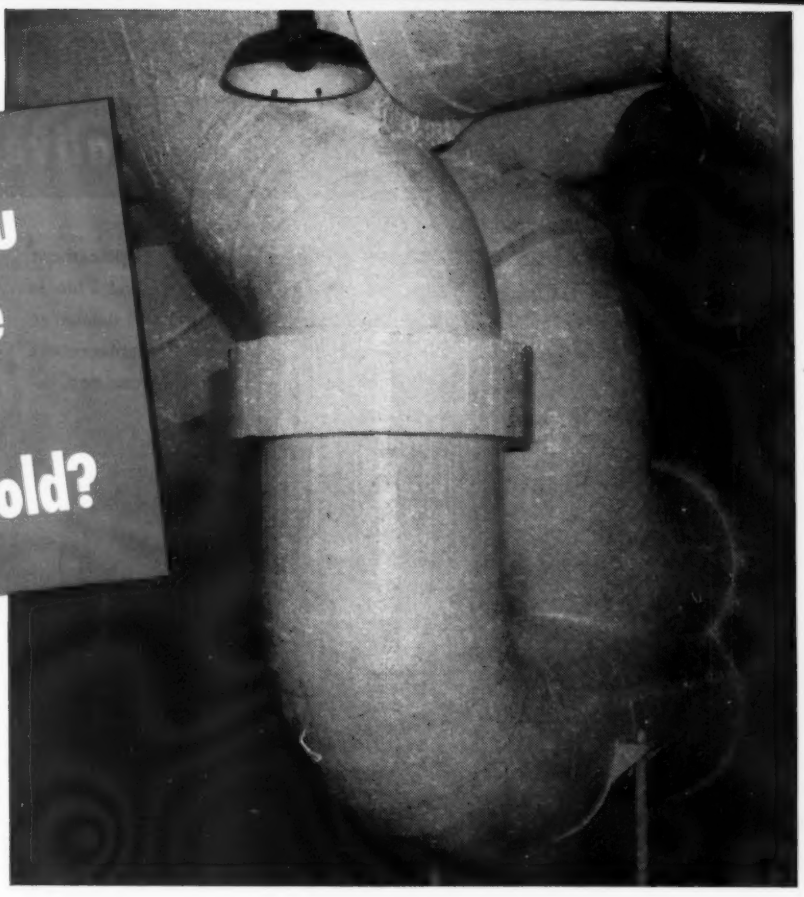
Prof. George F Bateman, dean of the School of Engineering at Cooper Union, New York City, died suddenly Jan. 30. Associated in a teaching capacity with Cooper Union ever since his graduation there in 1907, he was named dean in 1933. He was active in the affairs of ASME, the New York Electrical Society, American Society for Engineering Education, Engineers Council for Professional Development, and the Newcomen Society.

Alva J Chubb, 57, publisher of *National Engineer* and a member of National Assn of Power Engineers, Chicago 2, died in Methodist Hospital, Indianapolis, on Dec 31, 1947, following several weeks of illness. His home was in Greenfield, Ind.

Dr August C Klein, 61, vice-president and engineering manager, Stone & Webster Engineering Corp, Boston, died of a heart attack on Feb. 3. He was on a vacation trip to Jamaica, B. W. I.

Carroll E Maine, 72, a retired stationary engineer of Racquette River Paper Co, Potsdam, N. Y., died Jan 19. He had been associated with the company for 28 years, retiring in Jan 1947.

How would you insulate a line that delivers both heat and cold?



HERE'S THE PROBLEM: A piping system carries air to test airplane carburetors. For weeks the air is heated to 200° F. For somewhat shorter periods the same line delivers air at 75° below zero. What covering for the pipes will hold both these temperatures economically?

- ☐ 9" Cork covering or lagging
- ☐ 3" 85% Magnesia and 6" cork lagging
- ☐ Standard Thick Magnesia and 7" cork lagging

Here's what the Armstrong Engineer recommended:

The first suggestion—9" cork covering—would be excellent for the low-temperature phase of the operation. But the 200° F. heat would eventually cause the cork to shrink and crumble. It is never used for temperatures over 150° F.

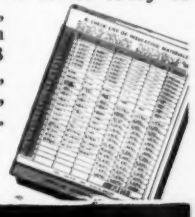
The second suggestion, 3" of Magnesia and 6" of cork, would provide sufficient insulation to permit economical operation of the line. However, three inches of magnesia is more than is required to reduce temperatures to within practical limits for the outer layer of cork when the line is operating at 200° F. Also, it would not take full advantage of the higher insulating efficiency of cork.

The third suggestion, Standard Thick Magnesia and 7" of cork lagging, is the most practical and economical specification for this line. Standard Thick Magnesia is sufficient to bring the temperature at the cork below 150° F. Over the Magnesia, 7" of cork lagging will provide adequate insulation to maintain the 75° below zero temperature for the length of time required on this job. And the cork lagging can be tightly sealed to prevent damaging vapor penetration when the line is operating at low temperatures.

An unusual problem like this cannot, of course, be solved by any simple rule of thumb. Dozens of factors must be analyzed and provided for. Armstrong's engineers are qualified by training and experience to give you the right answer. That's why it pays you to talk over your insulation problems with an Armstrong engineer. He can furnish expert advice, as well as the right materials and skilled workmen for applying them.

FREE! INSULATION CHECK LIST

This chart lists types and thicknesses of insulation for temperatures from 300° below zero to 2800° F. Write today to Armstrong Cork Co., Industrial Insulation Department, 7003 Maple Ave., Lancaster, Pennsylvania.



ARMSTRONG'S INDUSTRIAL INSULATION

Complete Contract Service For All Temperatures

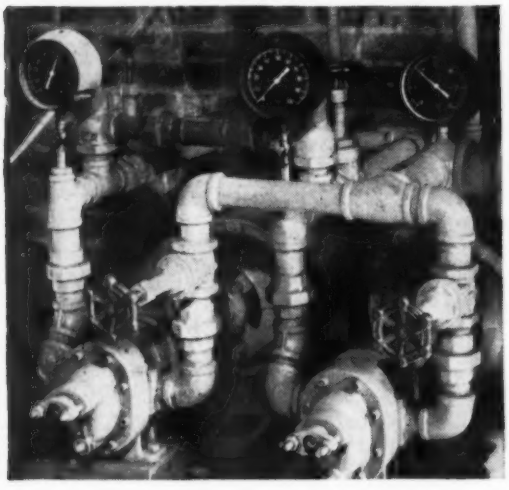
From 300° Below Zero — To 2800° Fahrenheit

SIER-BATH GEAREX PUMPS
—no pulse, but very much alive!

SIER-BATH GEAREX PUMPS are sturdy positive displacement units that discharge liquid without pulse or vibration. This is accomplished by means of double helical pumping rotors and discharge passages of proper area to insure continuous overlapping displacement of liquid. The rotors are not in contact, thus reducing wear and increasing life. If you are interested in pumping efficiency with low maintenance costs, write us for booklet.

SIER-BATH GEAREX PUMP

Balanced axial thrust • Vibrationless operation • Roller bushings for precision running under load.
Pumps: Oils, varnishes, solvents, molasses, chemical solutions
Capacities: 1-550 g.p.m.
Discharge: 250 p.s.i. for medium or high viscosities. 50 p.s.i. for water.



• The two Sier-Bath Gearex Pumps shown are installed in the boiler house of Metakloth Company, Lodi, New Jersey. They pump Bunker C fuel oil to the boiler at a pressure of 60 lbs. The user expresses complete satisfaction with the installation which was made in December 1946.

★

For higher pressures and capacities
use
SIER-BATH SCREW PUMPS

ALSO MAKERS OF SIER-BATH PRECISION GEARS

FOUNDED 1905 **MEMBER A. G. M. A.**

Sier-Bath
GEAR and PUMP CO., Inc.

9254 HUDSON BOULEVARD • NORTH BERGEN, NEW JERSEY

Robert Schoonmaker, founder and president of Diesel Motors Corp, Port Washington, L. I., N. Y., died at his home on Jan 6 as a result of a cerebral hemorrhage.

Charles H Smith, 86, a stationary engineer at Hanna Furnace Corp, Lackawanna, N. Y., died at his home on Dec. 27.

Patrick J Kiley, stationary engineer, died recently in a Utica, N. Y., hospital after a brief illness. He was employed by the Utica Board of Education for the last 19 years.

Paul D Hutton, 74, stationary engineer in Buffalo for many years, died Dec 30 in a Buffalo hospital. He was chief engineer and superintendent of maintenance of Washburn-Crosby Co div of General Mills until he retired in 1941.

James Henry Newns, former superintendent of construction at Toronto Power Co and Hydro Power Co for 25 years, died recently in Niagara Falls, Ont.

Henry A Bertelsen, 66, operating engineer on staff of Hotel Statler, Boston, Mass., died at West Concord, Mass., on Jan. 16.

Arthur Joseph Ennis, 74, for many years chief engineer at Iola Sanatorium, Rochester, N. Y., died Dec 21 as the result of a heart attack. He retired a few years ago.

John C O'Leary, 74, a retired stationary engineer, died recently at his home in Erie, Pa. He had been associated with Buckeye Pipe Lines, Berea, Ohio, for 40 years.

Francis A Ames, 65, a stationary engineer with Pennsylvania Asphalt Co, died recently at his home near Erie, Pa.

Pawell Lamar Paxton, 47, who, following his graduation from Virginia Military Institute, was associated with Central Gas & Light Co at Poughkeepsie, N. Y., the Virginia Electric & Power Co at Alexandria, Va., and L E Myers Co in Dallas, Tex., before returning to his native state of Va., died unexpectedly at Buena Vista, Va., on Jan 4.

Charles Angus Hurst, 68, a stationary engineer in Buffalo for two decades, died Jan 10. His most recent position was with Grennan Cakes, Inc.

Charles A Runckel, 67, boiler inspector for western New York territory of Hartford Steam Boiler Co of Cleveland, died Jan 12 at his home in Buffalo.

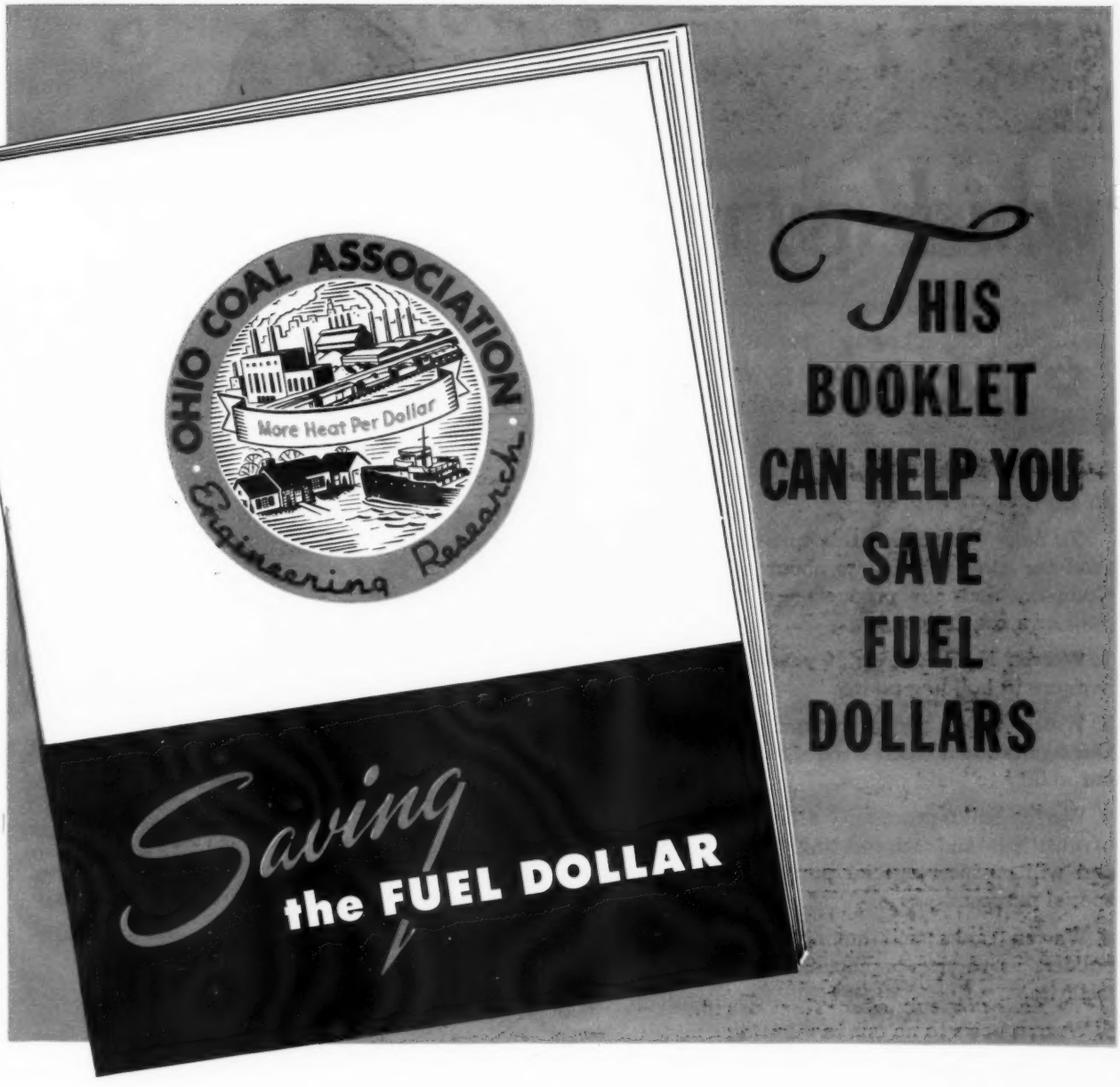
Joseph E Talling, 76, a retired chief stationary engineer, died Jan 12 in a hospital in Erie, Pa.

Edward S Dyer, 75, chief engineer at American Brewing Co, Rochester, N. Y., for the last 20 years, died recently after a brief illness.

Joseph A Loughlin, 85, former stationary engineer for Philadelphia & Reading Coal Co, Buffalo, died Jan 21 in Buffalo. He retired from the coal firm in 1935.

Roger V Terry, 49, assistant chief engineer of Newport News Shipbuilding and Dry Dock Co, died suddenly on Jan 9 while on a business trip to New York.

John E McDonnell, vice president and sales manager of McDonnell & Miller, Inc, makers of control equipment, died Jan 27 at St. Lukes Hospital, Chicago.



Just off the press, "Saving the Fuel Dollar" is full of valuable information for power plant designers, owners and operators — 20 pages on the vital subject of how to lower fuel costs . . . charts, diagrams, illustrations. For the first time, comprehensive information has been assembled under one cover on —

- **How fuel flexibility reduces power costs.**
- **How to conduct a competitive coal investigation before preparing steam plant specifications.**
- **How burning equipment affects fuel performance.**

and other helpful data of interest to power plant designers, operators, and owners concerned with erection, expansion or modernization of boiler plants, in easy-to-read form.

Free on request — write for your copy today.

OHIO COAL ASSOCIATION

ROCKEFELLER BUILDING • CLEVELAND 13, OHIO

which pump?

When you buy a pump you naturally expect good service, dependable operation, low power and maintenance costs and other benefits. The question is—which pump will give you these benefits in greater measure?

To help you answer this question read the clear statements about our Company and our products — draw your own conclusions.

1. Warren is backed by 50 years experience in building pumps.

2. Warren builds pumps *exclusively*. Our reputation is based *entirely* upon our ability to build pumps.

3. Warren builds practically *all types* of centrifugal and reciprocating pumps and will engineer special pumps for special purposes.

4. Warren ranks well among pump builders as to size, organization and facilities.

5. Warren bows to no one in selecting the right pump for the job. "A Warren recommendation is never a compromise."

6. Our customers include many of the famous names throughout industry.

7. Warren pumps are fairly priced—but not built to a price. Initial cost is insignificant when measured against results.

8. Warren pumps are guaranteed—not only as to quality and workmanship, but also for performance as rated when shipped. Maintained efficiency is inherent in every Warren design.

Why not put your pump problems up to Warren?

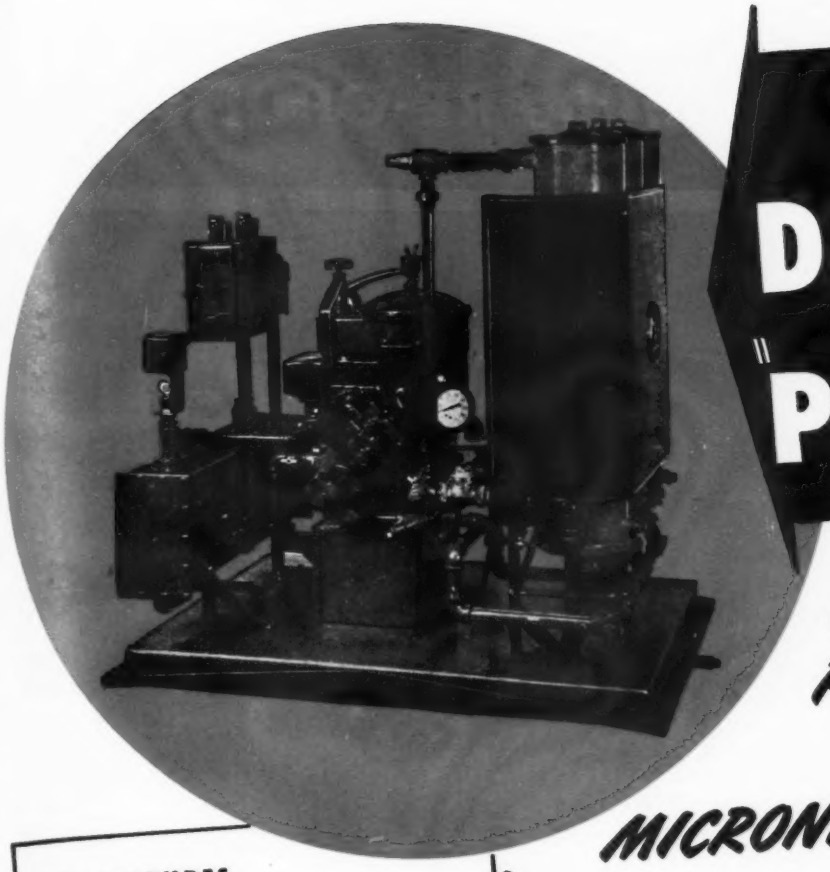
Our 50th Anniversary

WARREN PUMPS

Reciprocating and Centrifugal

WARREN STEAM PUMP CO., INC., WARREN, MASS.

Atlanta Boston Chicago Cleveland Denver Detroit Houston Manchester Los Angeles Minneapolis New Orleans New York Philadelphia Pittsburgh Richmond San Francisco Seattle St. Louis



The DE LAVAL "Puri-Filter"

CENTRIFUGAL PURIFICATION + MICRONIC FILTRATION

THE FEATURES OF THE "PURI-FILTER"

1. Removes dirt and water by centrifugal force
2. Filters out harmful carbon
3. Does not remove valuable additives
4. Cleans oil at moderate temperature
5. Speeds up inspection—crankcase is cleaner
6. Minimizes ring sticking
7. Increases bearing life
8. Saves labor—long runs without bowl cleaning
9. Increases oil life
10. No dirt...carbon...or water

What the "PURI-FILTER" IS

The De Laval "Puri-Filter" combines the De Laval "Uni-Matic" Oil Purifier which centrifugally removes most solid impurities and all water, and Fram "Filcron" Filters which, in cleaning the Diesel lubricating oil, also restore the oil to a translucent amber color. The De Laval "Puri-Filter" leaves the lubricating oil clean and dry . . . provides the *maximum* in protection for every engine. It is complete with dirty-oil and clean-oil pumps, and is piped ready to operate.

THE DE LAVAL SEPARATOR COMPANY
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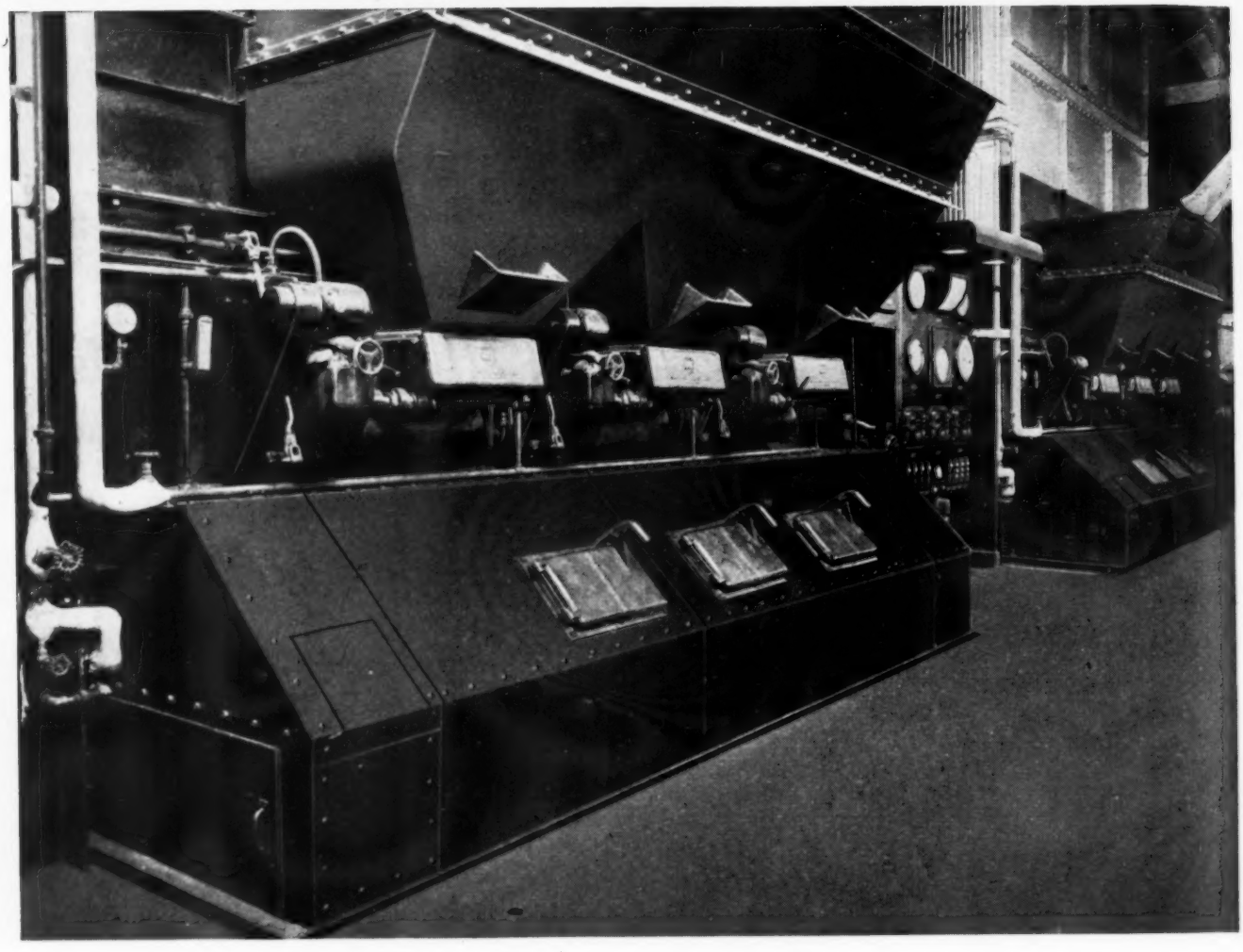
DE LAVAL PACIFIC CO., 61 Beale St., San Francisco 5
THE DE LAVAL COMPANY, Limited, Peterborough, Ont.

DE LAVAL OIL PURIFIERS

FOR DIESEL LUBRICATING OIL

The PROOF is in the RE-ORDER



...TWO MORE BROS TRAVL-SPRED STOKERS INSTALLED

Bros Travl-Spred Stokers combine both spreader feed and traveling grate . . . to give uniform fuel distribution plus continuous ash discharge.

In addition, they have the *Bros*-designed *tuyere-type grates* in individual units with cooling ribs for longer life . . . *zoned burning areas* to assure correct volume of air through various depths of the ash bed . . . and *hydraulic drive* for continuous operation at minimum cost.

All this is combined into a compact installation readily adaptable to existing boiler rooms . . . capable of *increasing steam output* and *decreasing power costs.*

For proof, take the case of the Chicago, Milwaukee, St. Paul and Pacific Railroad. The CMSTP&P installed two *Bros Travl-Spred* Stokers in their Milwaukee plant in the spring of '46. Today, they are installing *two more* in the same boiler room.

And we can show you hundreds such re-orders—the world's best proof of satisfactory performance. What's more, we can show you the exact *Travl-Spred* Stoker best suited to your requirements . . . a stoker that will give you more efficiency *and* more economy in steam production. So write to: Wm. Bros Boiler and Manufacturing Co., Minneapolis 14, Minnesota.

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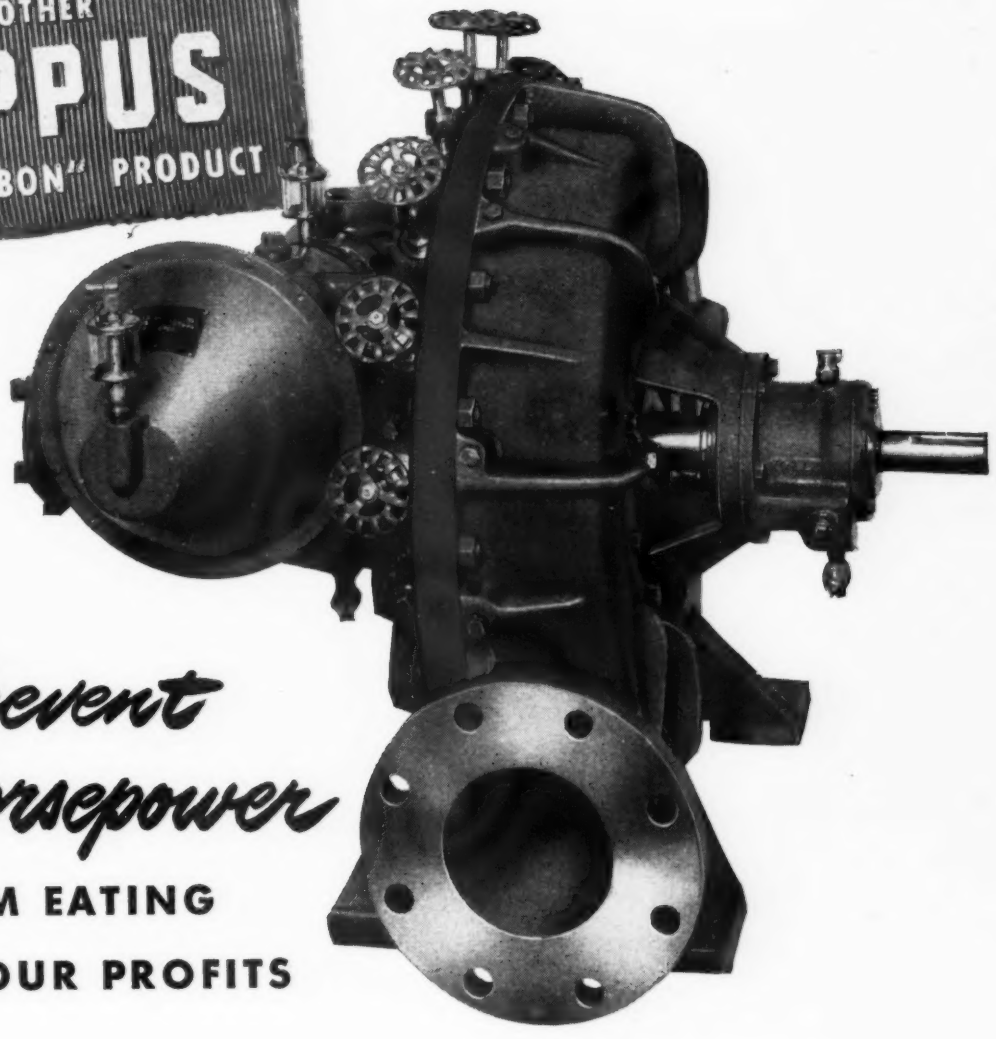
WATER TUBE, FIRE TUBE BOILERS • OVER FEED, UNDER FEED • HYDRAULIC-TRAVL-SPRED STOKERS

ANOTHER
COPPUS
"BLUE RIBBON" PRODUCT



Prevent Idle Horsepower

FROM EATING INTO YOUR PROFITS

Paying for a larger turbine than you need is a waste of money you can easily avoid. Coppus "Blue Ribbon" Turbines are designed to meet small-power requirements exactly. Made in six frame sizes — fractional to 150 hp, and priced accordingly — they're hard-working, smooth-running, always dependable... the logical, economical drives for your pumps, blowers, fans and similar equipment.

Coppus precision-builds these rugged performers, checks their close tolerances with Johansson blocks, gives each a thorough dynamometer test before shipment. That's why you can count on them for the cost-saving efficiency built into all Coppus "Blue Ribbon" products — blowers, ventilators, gas burners, etc.

Since 1937, over 85% of all orders for Coppus Turbines have been repeat orders. Add their rapidly increasing use on top-name original equipment and you have conclusive proof of their ability to make good on the job — *your* job.

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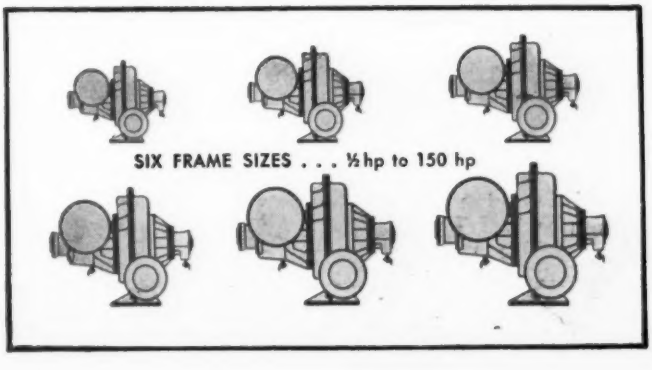
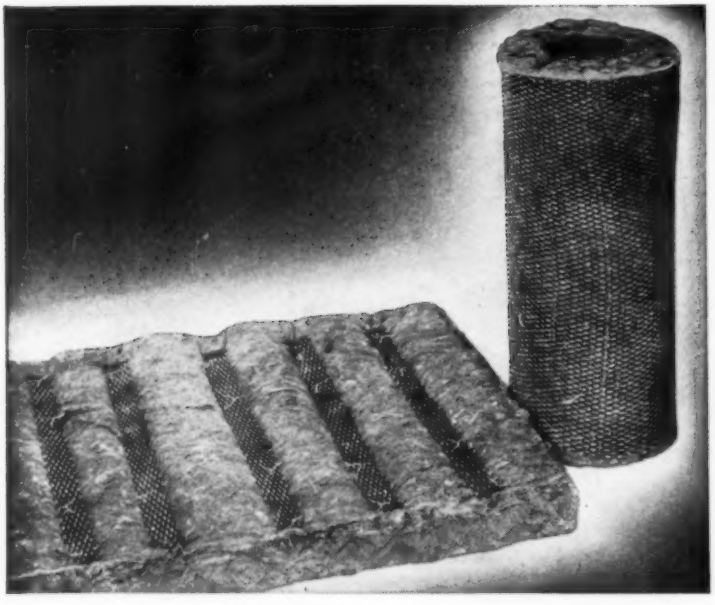
COPPUS ENGINEERING CORPORATION, 163 Park Avenue, Worcester 2, Mass. Sales Offices in THOMAS' REGISTER. Other products in BEST'S SAFETY DIRECTORY, CHEMICAL ENGINEERING CATALOG, REFINERY CATALOG.





More power
to you with
EAGLE-PICHER
Insulations

Eagle-Picher "77" Pipe Covering

is permanently efficient to 1200 F!

Because it remains efficient, even at the high temperature of 1200 F, Eagle-Picher "77" Pipe Covering is widely preferred by industry for permanent protection against heat loss through pipes. It consists of chemically and physically stable Eagle-Picher Insulating Wool felted and secured between metal fabrics. Does an outstanding job on steam piping and other types of hot lines. Can be cut on the job with ordinary metal shears. Water and steam repellent. Complete data sent on request.

The complete line of Eagle-Picher Insulations includes:

Eagle-Picher Super "66" Cement
Eagle-Picher Supertemp Block
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Low Temperature Felts
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EAGLE-PICHER
INSULATIONS for

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High and low temperature

Since 1843
THE EAGLE-PICHER COMPANY
CINCINNATI (1), OHIO

NEW! 1948 brings the 9 star

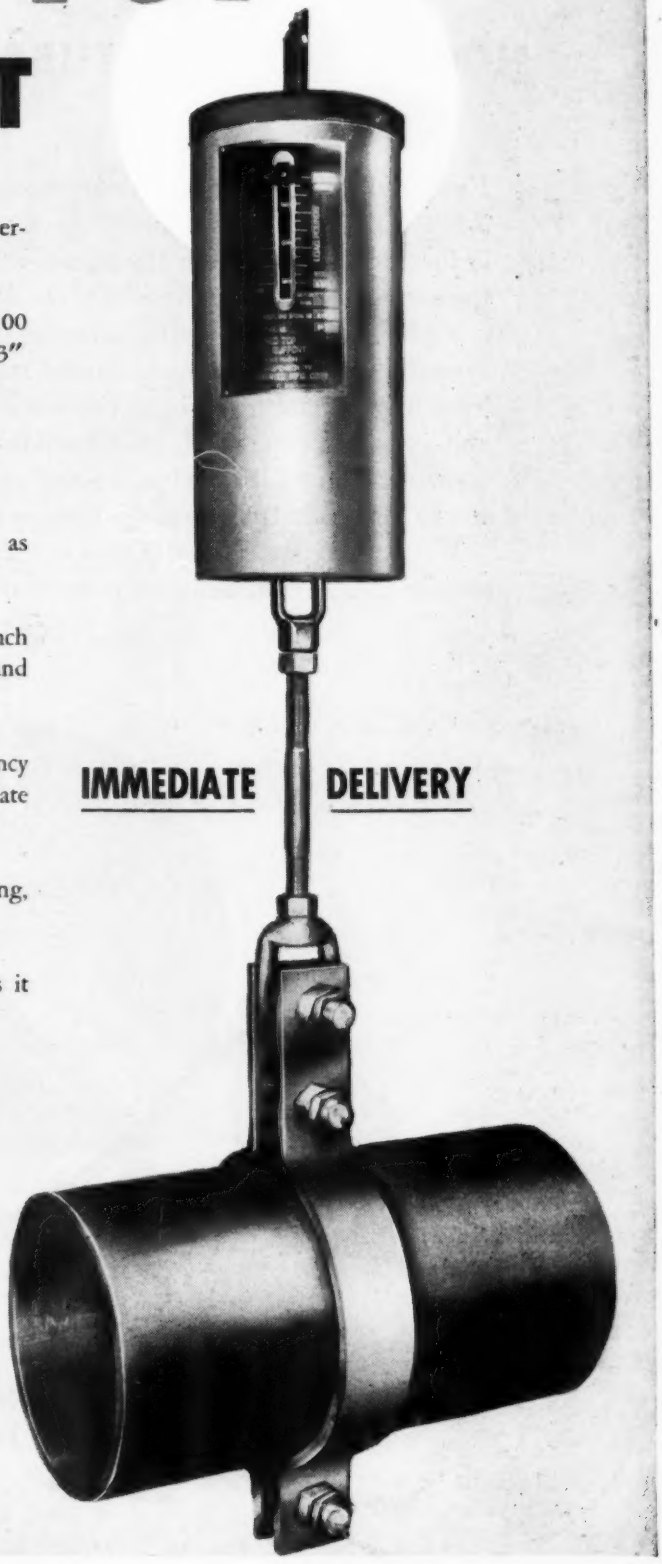
LEIBFRIED RED TOP*

PIPE SUPPORT

- Designed and standardized to meet modern engineering requirements at less expense.
- Three model sizes cover total load range from 100 to 5000 pounds, each size having travel range of 3"
- Easy selection of sizes from simple table.
- Low-priced and available immediately from stock.
- Easier and less costly to install properly, either as hangers or seats... no turnbuckles required.
- Variability, i.e. change of supporting force per inch of vertical travel movement, never exceeds 25% and may be as low as 14%.
- Actual load, travel, variability and natural frequency of vibration are all indicated instantly on scale plate for a given pipe position.
- "Cold"-load set is made in our shops, which setting, if desired, may be easily changed after installation.
- Neat appearance and compact. "Red Top" makes it easier to spot in service.

A few choice sales territories are available.

Send for Catalog No. 316.



IMMEDIATE DELIVERY

C. H. LEIBFRIED

Mfg. Corp.

PIPE SUSPENSION DIVISION

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Leakproof!

The Parker 3-Piece Fitting

HOLDS BEYOND TUBE-BURSTING PRESSURES

Even if used under pressures severe enough to burst the tubing, PARKER *3-Piece* Tube Fittings remain intact . . . and do not leak or distort. Pictured is just one sample from thousands of tests that have been made—all with the same leakproof performance result.

PARKER Tube Fittings control vibration better. They're easy to assemble . . . may be reassembled repeatedly. Shapes are machined from high-strength forgings. Offered in the widest range of shapes and sizes in brass, steel, stainless steel—and aluminum. Two styles—*3-Piece* flare-type and flareless Ferulok. Warehouse stocks conveniently located in all major industrial centers.

Write today for Fittings Catalog 202, Ferulok Bulletin A-57 . . . and name of nearest distributor.

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THE PARKER APPLIANCE COMPANY
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Plants: Cleveland and Los Angeles
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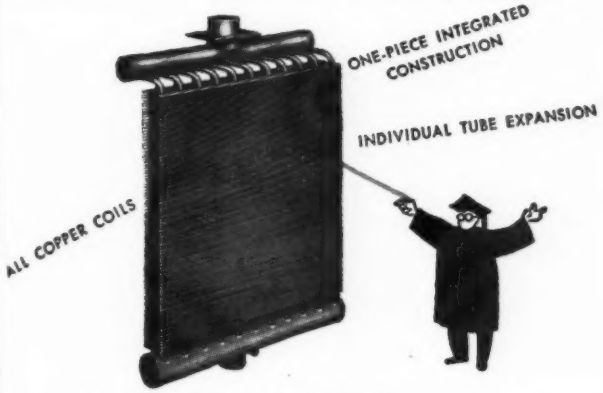
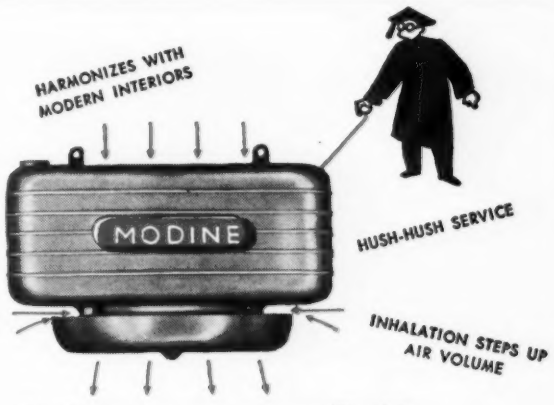
Up-to-the-Minute Answers to Your Unit Heater Questions!



Q. Are Coils made to last?

A. Modine coils defy corrosion and deterioration because fins are metallically bonded to tubes, tubes brazed to headers. No screwed or expanded joints, no gaskets or bolts mean greater strength, longer life.

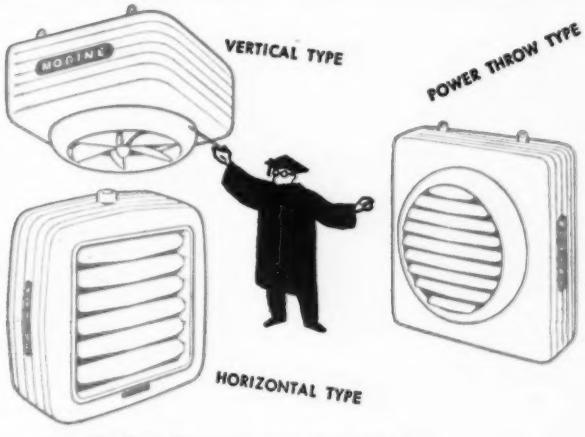


Q. Is Performance as you like it?

A. You get uniform temperatures, precisely controllable for perfect comfort, low cost because of Modine's flexible heat delivery. Heavy-duty motors are certified for quietness by laboratory sound ratings.

Q. What about Suspension?

A. Patented Modine center supply and return connections mean Horizontal unit can be suspended directly from supply line with safety. No expensive supports. No extra labor costs. Savings to $10 per unit.



Q. Will it fit your Application?

A. Modine's complete line meets your needs with 3 types and 47 capacities: 1) Horizontal Type for general applications. 2) Vertical Type for overhead use. 3) Power Throw Type for special high velocities.

GOOD ADVICE: Specify Modine High Quality!

Compare Modine cost . . . compare Modine design . . . compare Modine performance, and you'll see why Modine offers you today's greatest unit heater value . . . *the* quality unit heater for your needs! For more facts, call Modine's representative listed in the "Where-to-Buy-it" section of your phone book. Or send in coupon at right.

Modine UNIT HEATERS

MODINE MANUFACTURING CO.
1512 Dekoven Avenue
Racine, Wisconsin

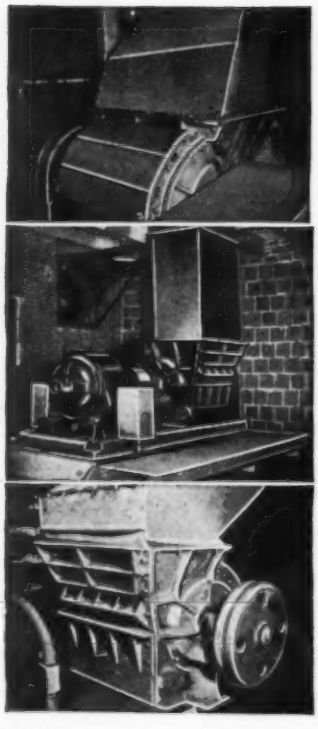
YES! I want all the facts about Modine's integrated Unit Heater Line. Please send me complete information.

NAME .....

ADDRESS .....

CITY .....STATE .....

1948 DESIGN FOR MORE EFFICIENT COAL PREPARATION



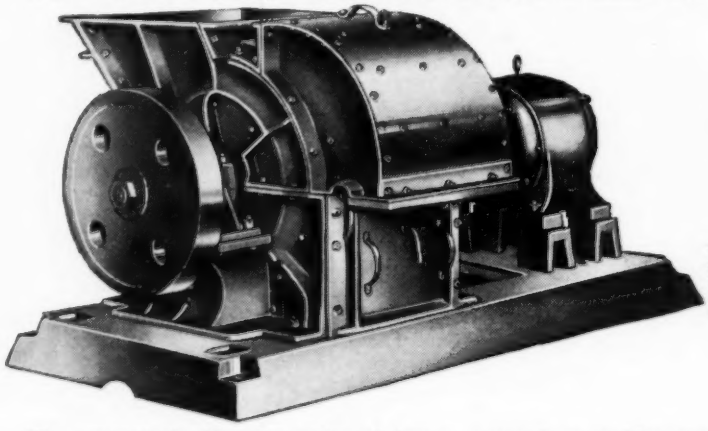
Changing over to Americans is easy because of their minimum headroom requirements and independence from auxiliary equipment.

AMERICAN *Rolling Ring* CRUSHERS

Reduces up to 500 TPH at less than 1c per ton!

With the constant demand for more kilowatt output, getting the most BTU's from each pound of coal is directly related. Here's where coal preparation enters into the efficiency of power production and that's where the American Crushers can improve your efficiency.

The American Rolling Ring Crusher reduces ROM Coal to uniform size for efficient firing.



The basis for greater crushing efficiency is the manganese shredder rings — exclusive with American.

The patented shredder ring action of Americans, through splitting instead of crushing coal results in a uniform product with controlled fines. For stoker feed sizes down to ¼" fines are minimized to the point that subsequent screening is not required to obtain a product that permits a loose firebed that responds to sudden steam demands—admits oxygen for efficient burning and yet does not have excessive ashpit drop.

The fineness to which Americans will grind pulverizer sizes without oversize reduces the load on the ball grinders and increases preparation efficiency in pulverizer feed operations.

The American bulletin "Crushing Coal for Less Than 1c Per Ton" is yours for the asking. Write for it.

American PULVERIZER COMPANY

Originators and Manufacturers of Ring Crushers and Pulverizers

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TUBE CLEANERS

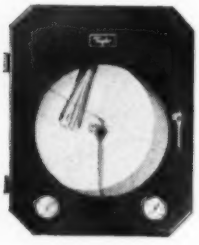
In all our 38 years of specialization in the manufacture and sale of tube cleaners, none can even remotely approach the power, efficiency, and cleaning speed of the new ROTOJET. Send for new bulletin showing the complete range of sizes for operation with water, air, and steam.

ELLIOTT COMPANY – ROTO DIVISION

153 SUSSEX AVENUE NEWARK 1, N. J.

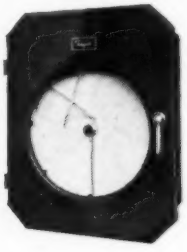
RECORDING FULSCOPE CONTROLLER

For desuperheaters, or for any close, accurate control of temperature, pressure, flow or liquid level. Quickly adapted to any operating requirements.



RECORDING THERMOMETER OR PRESSURE GAUGE

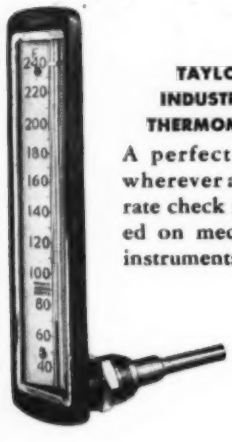
Accurately records steam and feed water temperatures and pressures or oil, air and flue gas temperatures. Dependably accurate *wherever* you need a record of pressure and temperature.



TAYLOR DIAL THERMOMETER

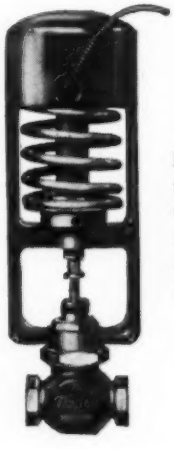
For transformers, coal-air mixture in powdered coal ducts, air compressor discharge, turbine and generator bearings. Available with electric alarm devices.

How to be Instrumental in saving your company money



TAYLOR INDUSTRIAL THERMOMETER

A perfect choice wherever an accurate check is needed on mechanical instruments.



TAYLOR SELF-ACTING CONTROLLER

For dependable temperature control on hot water storage tanks, air compressor jacket water.

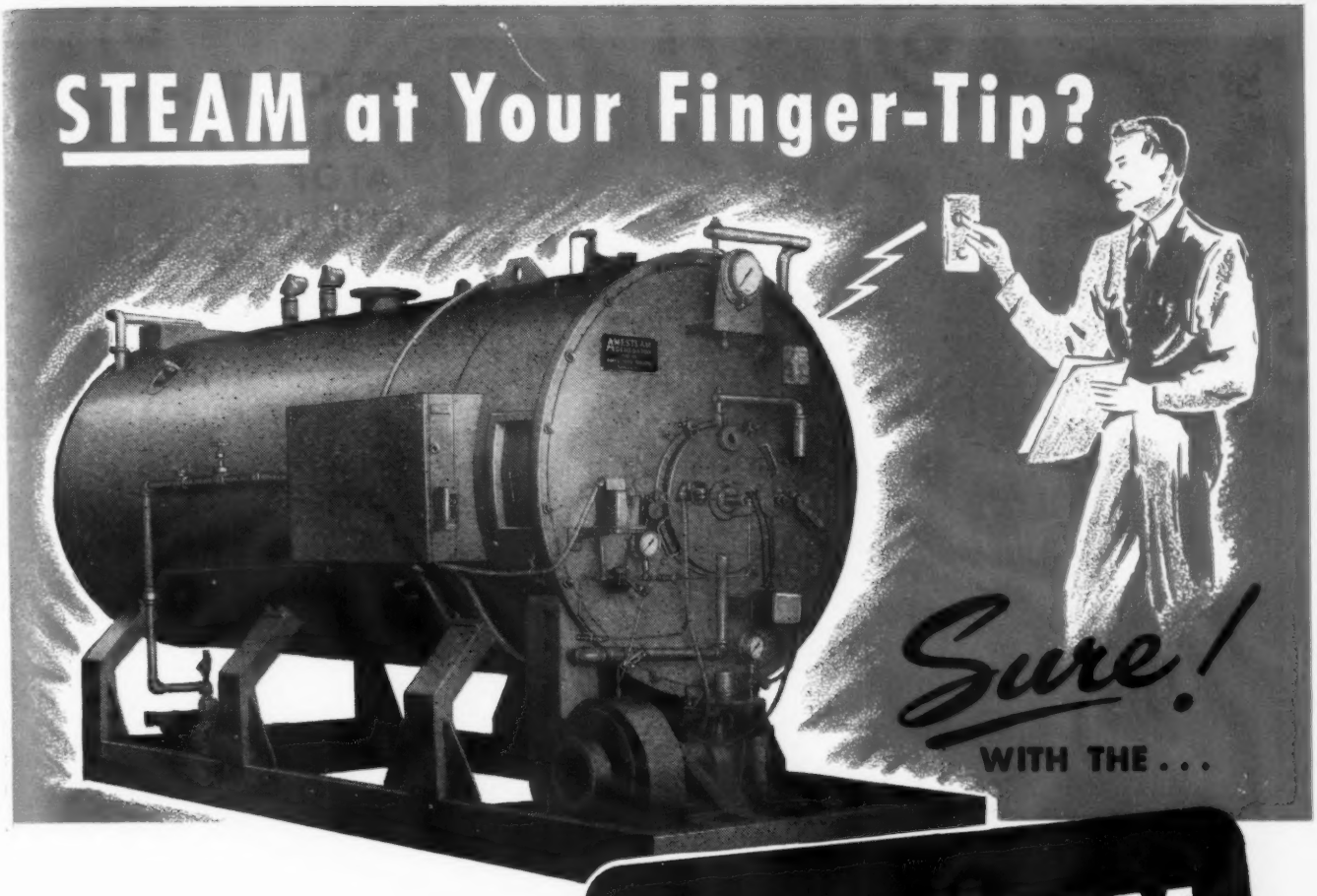
ARMORED ETCHED STEM THERMOMETER

Ideal wherever you need a test check on temperatures. Also available in unarmored types.

MAYBE no man can be a hero to his boss. But instruments like these *will* help you get credit for increasing operating efficiency and cutting costs. Of course, they're only a few of the complete line we can offer you for better measurement or control of temperature, pressure, flow or liquid level. Ask your Taylor Field Engineer! Taylor Instrument Companies, Rochester, N.Y., or Toronto, Canada.

Taylor Instruments
MEAN
ACCURACY FIRST
IN HOME AND INDUSTRY

STEAM at Your Finger-Tip?



● This is a size A-125 — 125 h.p. AMESTEAM Generator equipped for burning light oil.

AMESTEAM GENERATOR

YOU enjoy true "pushbutton" control with the AMESTEAM Generator—the completely automatic, self-contained packaged steam unit with 80% operating efficiency.

AMESTEAM Generators require a minimum of supervision, no labor for fuel handling or ash removal, and no banked-fire periods. You start operation with a pushbutton, and the unit delivers full steam pressure in a few minutes.

Available in sixteen sizes from 10 to 300 h.p., and in pressures from 15 to 200#, AMESTEAM units may be provided to burn heavy or light oil, or gas or may be provided with both oil and gas burners for your advantage in situations of fluctuating fuel supply and cost.

Installation of the AMESTEAM Generator is also simple. No foundation or brick setting is necessary. Connect the AMESTEAM Generator to your steam, water, fuel and electric lines and you are ready to go. No large stack is needed, just a vent to the outside. All control and safety mechanisms are built in and ready to operate. Every standard AMESTEAM Generator includes condensate unit complete with feed water pump and condensate tank.

AMES IRON WORKS Oswego, N.Y.

IF you are handicapped by insufficient steam capacity, obsolete boiler equipment, fuel difficulties or labor shortage, you may find an AMESTEAM Generator to be your answer. Write today for specific information on a generator for your needs, or for general bulletin describing all sizes.

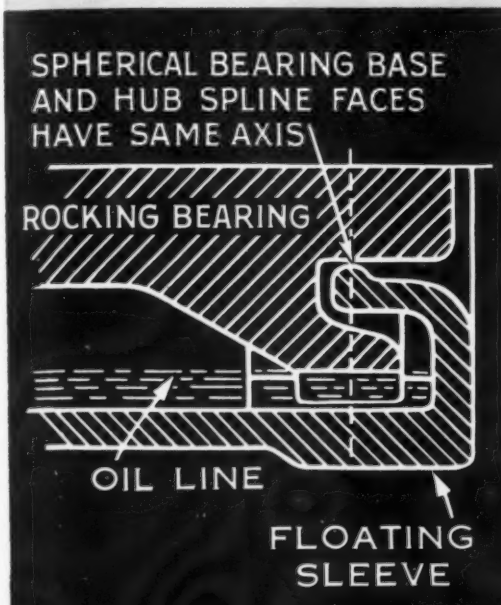
AMES IRON WORKS
BOX 803
OSWEGO, NEW YORK

May I hear more about the AMESTEAM Generators? Please send bulletin.

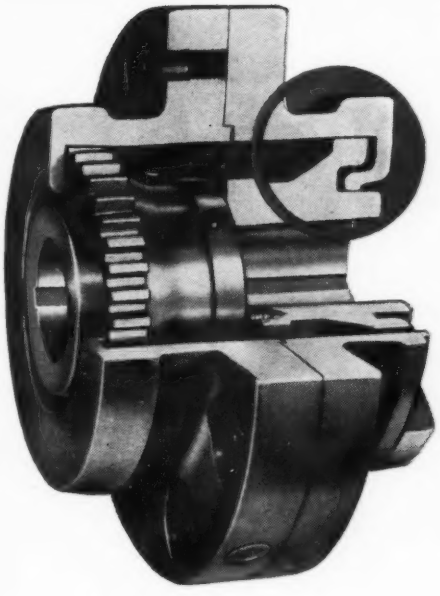
Name.....
Company.....
Address.....
Type of Business.....
Estimated Capacity Needed .....

PERCHED HIGH ATOP A BUILDING . . . YET
Whitman's
CHOCOLATES
GUARANTEED TO WITHSTAND HURRICANE WINDS UP TO 100 MILES PER HOUR
C. H. Wheeler Water Cooling Towers are guaranteed against winds up to 100 miles per hour, those above 75 m.p.h. being considered hurricane velocity. The United States Weather Bureau tells us that "except in connection with tornadoes and tropical hurricanes, wind velocities in excess of 100 m.p.h. are relatively infrequent in the United States." Guaranteed wind resistant construction, plus guaranteed water cooling performance, efficient operation with minimum water losses and over 50 years' experience are reasons why you should prefer C. H. Wheeler Cooling Towers. Photo shows a tower with steel casing and redwood fill. Send for Catalog 145.
C. H. WHEELER MFG. CO.
1800 Sedgley Ave., Philadelphia 32, Pa.
REPRESENTATIVES IN MOST PRINCIPAL CITIES
WATER COOLING TOWER
C. H. Wheeler
OF PHILADELPHIA
C. H. Wheeler
STEAM CONDENSERS · AIR EJECTORS
COOLING TOWERS · HEAT EXCHANGERS
OF PHILADELPHIA

What's the BIG IDEA in Fast's Couplings?



THIS METAL TO METAL SEAL GIVES YOU EXTRA PROTECTION AGAINST COUPLING SHUTDOWNS



YOU can forget about coupling shutdowns once you've installed all-steel Fast's self-aligning Couplings in your plant. There's nothing to wear, nothing to fail in a Fast's. Even the load-carrying oil is protected by an exclusive "rocking bearing" (shown in circle). This bearing is *exclusive* in providing a positive metal-to-metal seal against wear-producing moisture, dust and grit. The bearing is also exclusive in its correctly engineered position which allows *freedom of movement* to compensate for misalignment because its *spherical* base has *the same axis* as the hub spline faces. No perishable packing rings are used. That's the "big idea" that helps Fast's Couplings give you uninterrupted power transmission!

We have a complete line of couplings for immediate delivery. When you buy any one of them, you buy years of top engineering experience, Koppers' high standard of workmanship and unexcelled coupling service that assures a ready source of spare parts, no matter how old your couplings may be. Result: longer machine life, lower upkeep costs, minimum shutdown losses. For full information on Fast's, the *original* gear-type coupling, fill out the coupon below and mail it to: Koppers Co., Inc., Fast's Coupling Dept., 243 Scott St., Baltimore 3, Maryland.

K KOPPERS

FAST'S *self-aligning* COUPLINGS

SEND FOR FREE CATALOG giving detailed descriptions, engineering drawings, dimension and capacity tables, and typical installation photographs for the many types of Fast's Couplings. Fill out this coupon and mail it to: Koppers Co., Inc., Fast's Coupling Dept., 243 Scott St., Baltimore 3, Md.

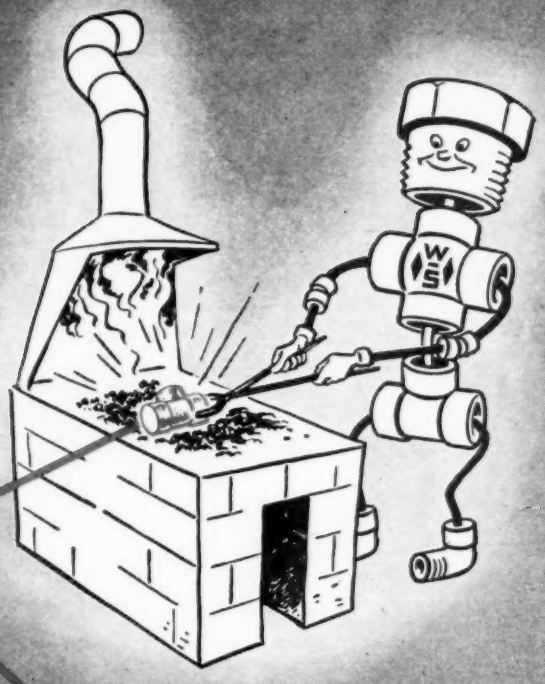
Name..... Position.....

Company.....

Street..... City..... State.....

INVESTIGATE FORGED FITTINGS...

COST
WEIGHT
AVAILABILITY



W-S FORGED STEEL FITTINGS FOR ALL SERVICES

Now is the time to consider W-S forged steel fittings for *all* services.

The price differential between forged fittings and cast types is less than ever before. Remember, too, that tough, accurately machined, *forged* steel fittings pay for themselves many times over in greatly reduced maintenance and down-time. Service life is phenomenal. Just put them in and forget them.

Of course, you'd expect *forged* fittings to be stronger, but did you know that, service for service and size for size, they are smaller and lighter in weight than most cast types having only a fraction of their pressure rating?

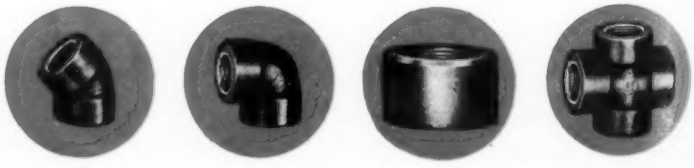
W-S distributors are located in principal cities. Consult the one nearest you about the use of stronger, lighter, cost-saving Forged Fittings for *all* services. They're available for quick delivery.

WATSON-STILLMAN

ROSELLE, NEW JERSEY

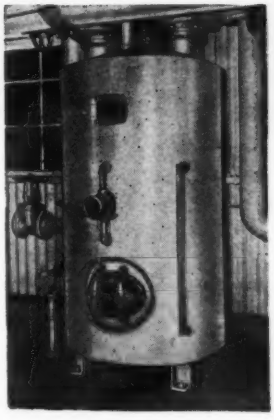
1848—CENTENNIAL—1948

SOLD THROUGH LEADING DISTRIBUTORS



4070

COCHRANE HOT PROCESS SOFTENER OF 36,000 GPH CAPACITY SHOWING 18 FT. SEDIMENTATION TANK AND ONE OF FOUR ANTHRACITE FILTERS LOCATED OUTSIDE THE POWER HOUSE. BELOW IS SHOWN FLASH TANK OF COCHRANE CONTINUOUS BLOWOFF SYSTEM WHICH PRODUCES 2900 lb/hr FLASH STEAM FOR SUPPLEMENTARY FEEDWATER HEATING.



Brave New Power Plant

with COCHRANE HOT PROCESS SOFTENER

AT BRAVE, a village in southwestern Pennsylvania, the People's Natural Gas Company have a compressor station for which a new power plant was required. The Machinery Division of Dravo Corporation, Pittsburgh, was chosen to build the power plant. Obviously, all equipment selected was such as to insure the highest efficiencies combined with operating economy.

The result justifies this selection for not only is the compressor station handling more gas today than at any previous time in its history but coal consumption has been cut 100 tons per day!

The feedwater (100% makeup) for the boilers is obtained from a nearby creek and is treated in a 36,000 GPH Cochrane Hot Process Softener. A Cochrane Continuous Blowoff System maintains uniform boiler concentrations and provides low pressure steam for supplementary feedwater heating. The famous Cochrane Multiport Relief Valves are also used in this installation, one on the steam line to the softener and two on the barometric condensers.

Literature describing this equipment may be had by writing COCHRANE CORPORATION, 3106 North 17th Street, Philadelphia 32, Pa.

DESIGN
MANUFACTURE
ERECTION

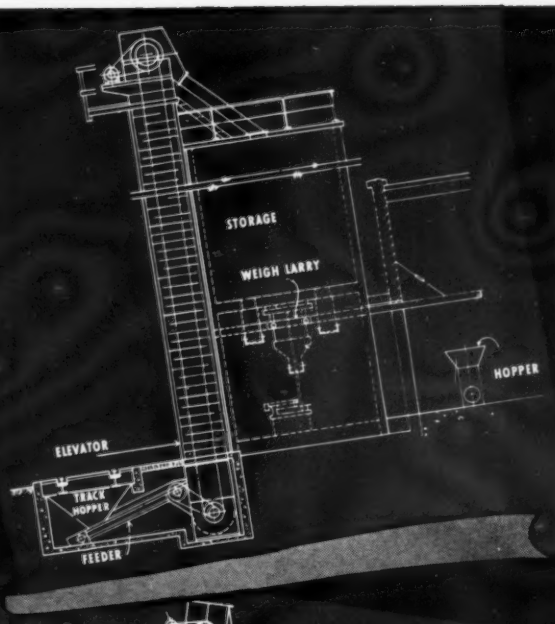
"packaged"
coal-handling systems
by G-W. These three basic systems for handling coal (and/or ashes), designed by G-W, have been adapted to varying conditions in boiler plants.

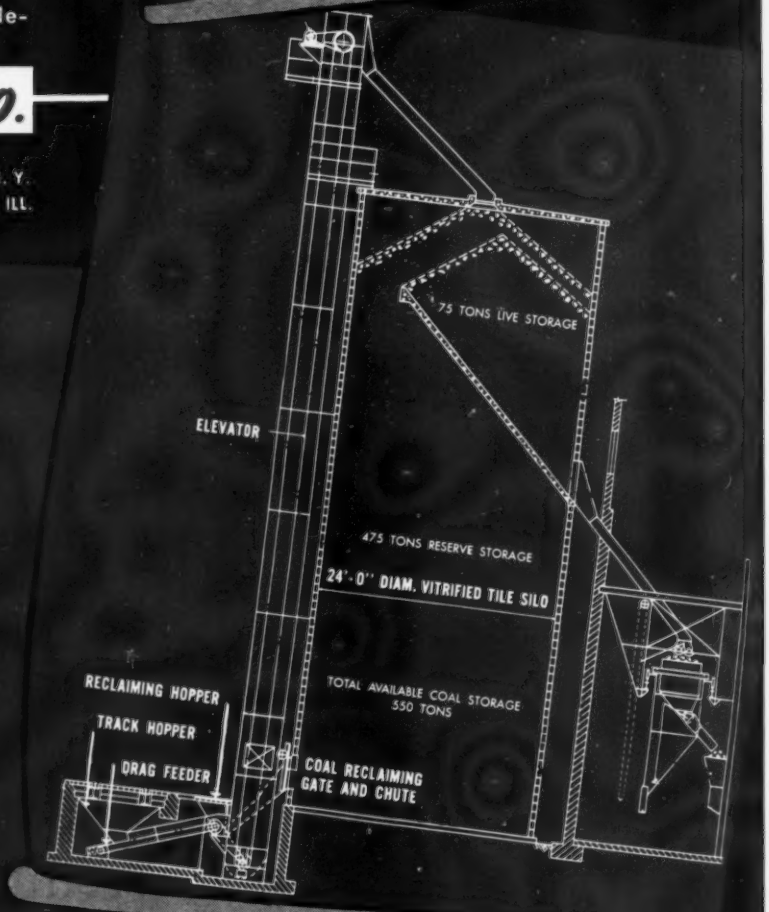
Let G-W do the entire job for you...design, manufacture, erection . . . shoulder all details . . . assume all responsibilities.

GIFFORD-WOOD CO.

Since 1814

420 LEXINGTON AVENUE • NEW YORK 17, N. Y.
565 W. WASHINGTON STREET • CHICAGO 6, ILL.
Factory—Hudson, N. Y.



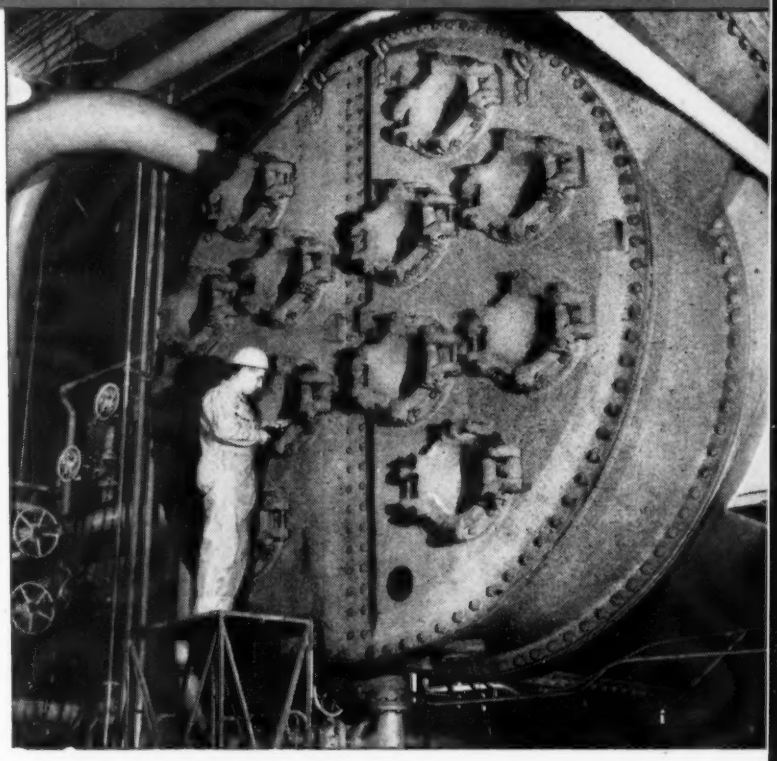


DOWELL

SPECIALISTS IN SCALE AND SLUDGE REMOVAL WITH CHEMICALS

clean condensers rapidly—

the chemical way!



Engineers responsible for power plants in many industries know that *clean* condensers and boilers are important factors in *keeping down costs.*

To help you keep down costs and maintain designed operating efficiency in many types of heat exchange equipment, Dowell offers a fast, reliable chemical scale removal service which has been proved in thousands of successful cleaning jobs.

Dowell engineers fill the equipment with liquid solvents designed to dissolve and disintegrate the scale and sludge deposits which retard heat transfer. Dismantling is unnecessary; down time is reduced to a minimum.

Dowell engineers are experienced, know which solvents to use, and have the necessary equipment—special truck-mounted tanks, pumps, heaters and chemical proportioners—to make possible control of each stage of the job.

To clean condensers, boilers, many other types of heat-exchange equipment, water lines and water wells—call Dowell. Ask for literature and a prompt estimate on *your* job.

DOWELL INCORPORATED · TULSA 3, OKLAHOMA

SUBSIDIARY OF THE DOW CHEMICAL COMPANY

CALL

New York	Buffalo	Wichita	Mt. Pleasant, Mich.
Boston	Cleveland	Oklahoma City	Hamilton, Ohio
Philadelphia	Pittsburgh	Houston	Charleston, W. Va.
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Long Beach, Casper: Dowell Associate—International Cementers, Inc.

DOWELL

A SERVICE ORGANIZATION

Take a WALWORTH No. 225P Bronze Valve Apart...

COMPARE IT PIECE BY PIECE

It will pay you to look inside the Walworth No. 225P. Compare the improved design, construction and convenience features shown in the "exploded" view. Notice the husky bronze body, the removable seat and disc, the oversize stem, all assuring maximum protection against wear and leakage.

Further, No. 225P is the TOUGHEST bronze valve your money can buy. The stainless steel, noncorrosive seats and discs are heat treated to a hardness of 500 Brinell — hard enough to scratch glass and crush nails. For this reason, the valve can be closed on sand, slag, scale and similar flotage without injury to the seating surfaces, and "wire drawing" is practically eliminated. Thus years of tight, positive shut-off are assured.

Available in both globe and angle types (angle type: No. 227P) in sizes ¼" to 2", this quality valve is recommended for 350 lbs. W.S.P. at 550 F, and 1000 lbs. non-shock service on cold water, oil, gas or air.

For full data on this long-life, economical Walworth Bronze Valve, see your local Walworth distributor, or write for Circular 82.

WALWORTH

valves and fittings

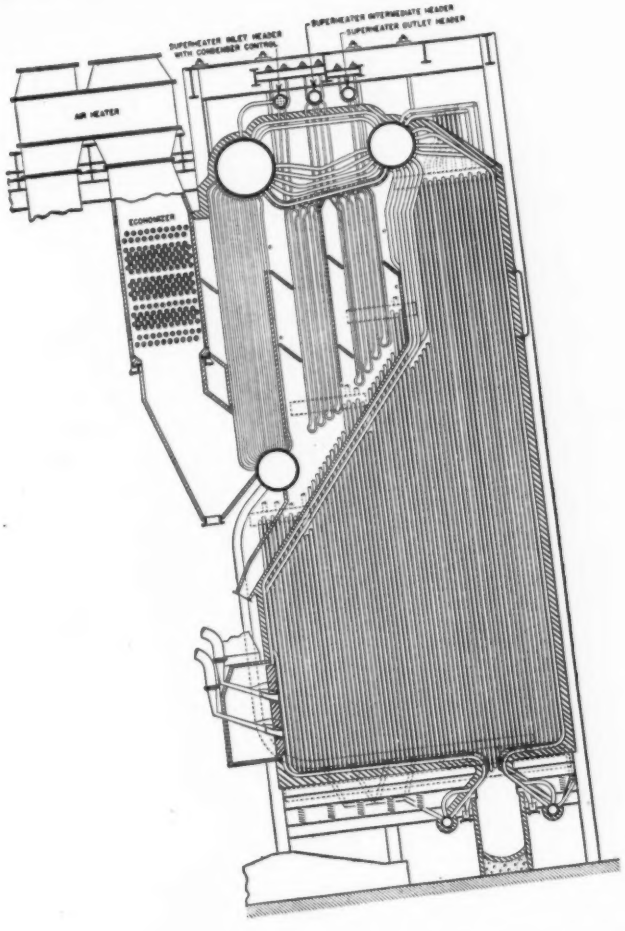
60 EAST 42nd STREET, NEW YORK 17, N. Y.

DISTRIBUTORS IN PRINCIPAL CENTERS THROUGHOUT THE WORLD

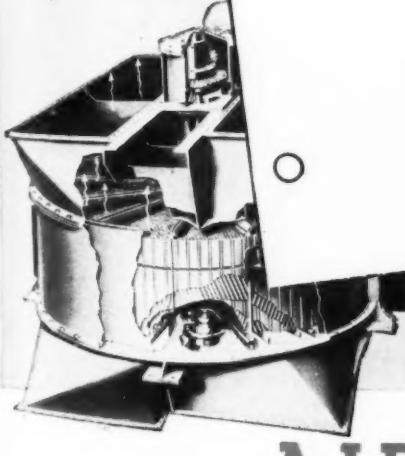
ENGINEERING PROGRESS REPORT #18

LJUNGSTROM AIR PREHEATER

A MIDWEST POWER PLANT



Here is another application of a Ljungstrom Air Preheater to a Foster Wheeler boiler.



THE

AIR PREHEATER

CORPORATION

Executive Offices: 60 East 42nd Street, New York 17, N. Y. • Plant: Wellsville, N. Y.

Engineers agree, **"they go in faster and stay in longer"**

NATIONAL SEAMLESS
BOILER TUBES

THE record of outstanding reliability that these famous "Walls Without Welds" have established during more than half a century of power plant service is due primarily to one thing—the unique piercing process by which U·S·S NATIONAL Seamless Boiler Tubes are made.

Making boiler tubes by piercing a solid billet of steel is a drastic test of steel quality. No other method offers such positive assurance of uniform wall strength. One continuous piece of steel from end to end, NATIONAL Seamless Tubes assure the safety, security, and dependability of a solid steel forging. There is no weld of any kind to provide a starting point for failure—the wall strength is uniform throughout.

Their better heat transfer characteristics, their higher creep strength at elevated temperatures, and their easier, faster installation result from the fact that NATIONAL Seamless Tubes are made from completely "killed" (thoroughly oxidized) steel and that every tube has been 100% annealed.

NATIONAL TUBE COMPANY
PITTSBURGH, PA.
Tubing Specialties Division
Columbia Steel Company, San Francisco, *Pacific Coast Distributors*
United States Steel Export Company, New York

WALLS WITHOUT WELDS

UNITED STATES STEEL

dissipated is right!

The staggering cost of BTU'S dissipated in your plant every day, every night, is a real headache if you're trying to cut costs. (And who isn't!) Waste occurs whenever and wherever inefficient insulation—or *no* insulation—gives heat energy an excuse to "pass out". Industry picks up the check for these escapades—and it isn't hay!

CAREY'S THE DOCTOR . . . on call, 24 hours a day, with COMPLETE INSULATION SERVICE to help diagnose causes of chronic heat dissipation in your plant . . . to administer a sure cure. **CAREY** offers complete industrial insulation engineering facilities, built up by over 75 years of serving industry. Those facilities are doubly valuable because they are backed up by:

1. engineering know-how gained from countless actual experiences on industrial insulation jobs of all sizes and shapes.
2. a complete line of industrial insulation materials

ROCK WOOL—MAGNESIA—ASBESTOS

3. materials strategically warehoused from coast to coast.

ALL OF THIS IS AVAILABLE to help you in *any* way . . . from an insulation survey to a complete installation. Take advantage of it! Meanwhile you'll want to . . .

Write for your free copy of "Heat Insulation For Industry." This helpful booklet is an excellent guide to selection of industrial insulation—contains specifications and tables you'll want to keep handy. For your *free* copy address your request to Dept. PO-3.

Carey *75 years serving home and industry*

THE PHILIP CAREY MANUFACTURING CO., CINCINNATI 15, OHIO

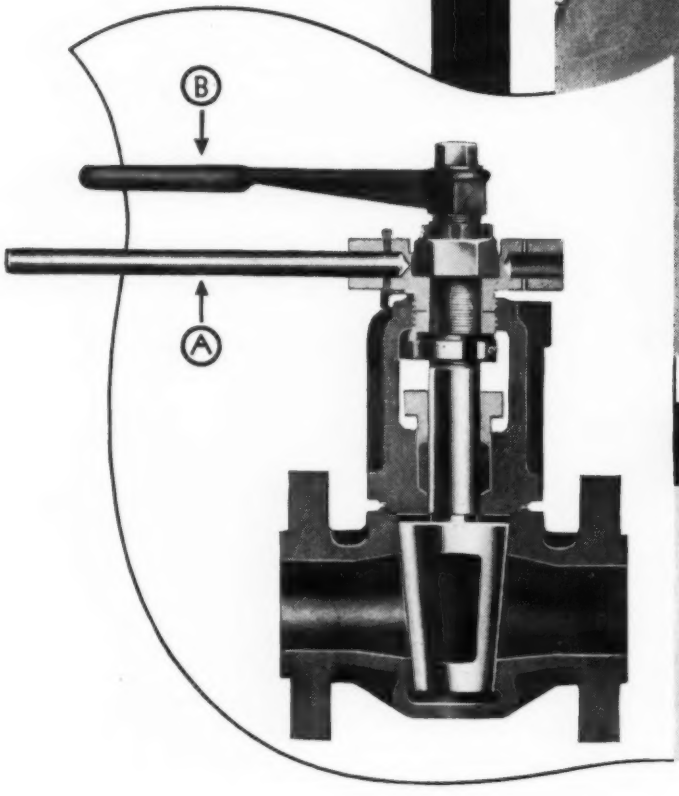
In Canada: The Philip Carey Co., Ltd., 1557 MacKay Street, Montreal 25, P. Q.

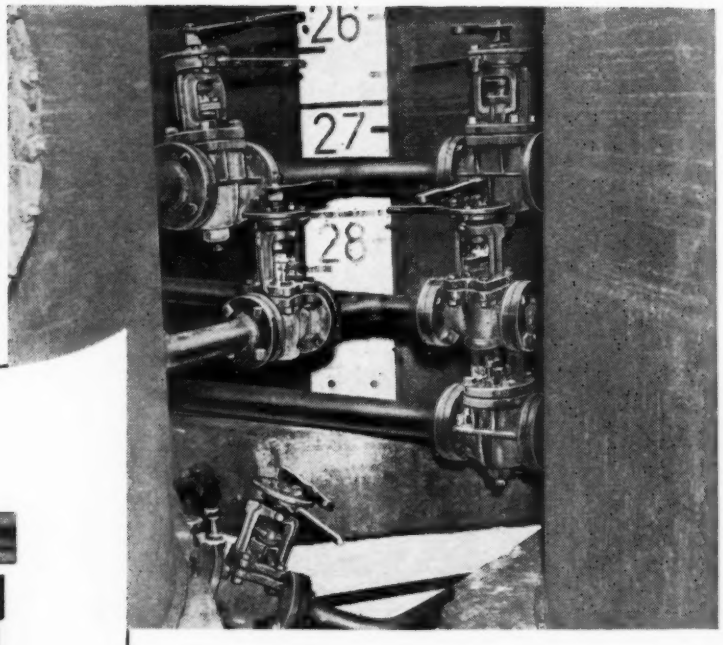
ROCK WOOL
MAGNESIA
ASBESTOS

Pipe Coverings • Sheets • Blocks
Batts • Papers • Air-Cell

"Instant, Stick-Proof Operation *at all Times, Under all Conditions*"

with HOMESTEAD Lever-Seald Valves





NOTE THESE OUTSTANDING FEATURES

1. Instant Stick-proof operation.
2. Quarter-turn fully opens or closes.
3. Positive seal without lubrication.
4. Seating surfaces always protected in both open and closed positions. Corrosion practically eliminated.
5. Unobstructed straight-line fluid flow.
6. All operating parts protected from damaging effects of service conditions and weather.

A powerful lever-and-screw device—built into each valve—prevents sticking and assures positive action at all times and under all conditions. Corrosive or viscous fluids, temperatures as low as 40° below Zero or as high as 1120° F., pressure or other adverse conditions that ordinarily cause valve failures, cannot affect the operation of Homestead Lever-Seald Valves.

Homestead Lever-Seald Valves operate faster too, 16 to 28 times faster than screw-stem-type valves. Seating pressure is first relieved with the lower lever "A" just enough to overcome friction. Then a quarter-turn of the upper lever "B" fully opens or closes the valve. Full seating pressure is again applied with the lower lever to make a positive, leakless seal.

Homestead Lever-Seald Valves can be furnished in combinations of metals and alloys to suit your requirements in sizes 1½" to 10", for pressure from vacuum to 1500 pounds.

Write today for full information and copy of Section 3, Valve Reference Book No. 39.

HOMESTEAD VALVE MANUFACTURING CO.

P. O. BOX 210 CORAOPOLIS, PA.

WHAT CAUSES BOILER DEPOSITS?

Boiler deposits (scale and sludge) originate primarily from boiler make-up water, contaminated condensate returns, and corrosion of metal parts in the water system. Under the influence of heat and concentration, certain materials come out of solution and adhere to heat transfer surfaces as scale or sludge.

Drew Power Plant Chemicals and Services have been developed for the prevention of such deposits and for handling the other difficulties encountered in the use of industrial water.

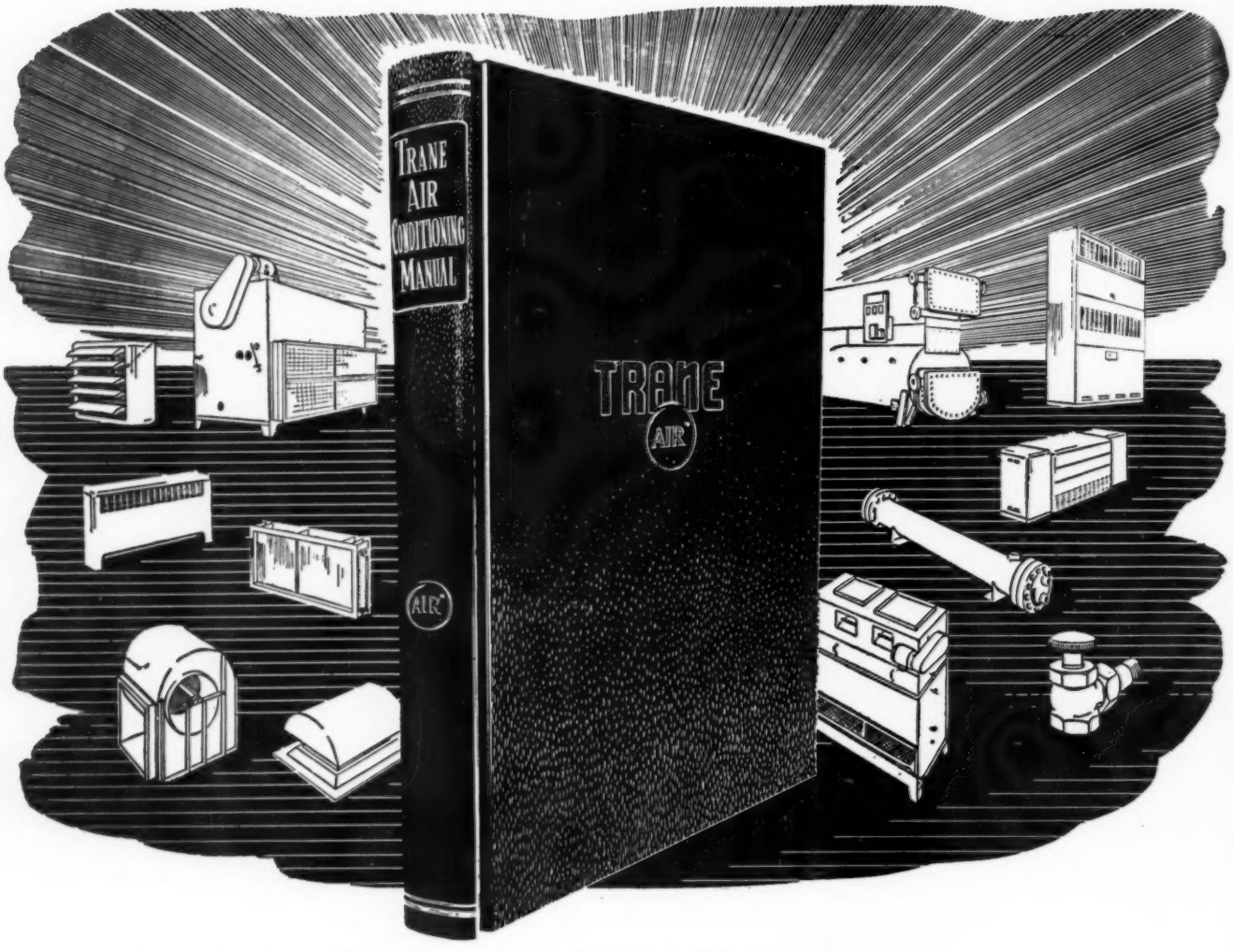
Our Engineers are always at your service.

E. F. DREW & CO., INC.

15 E. 26th St., New York 10, N.Y.

COMPLETE SERVICE BY DREW ENGINEERS IS AVAILABLE IN KEY CITIES OF THE U.S., CANADA, BRAZIL, ARGENTINA, MEXICO AND PUERTO RICO

POWER DREW CHEMICALS



ENGINEERED AIR CONDITIONING

by the Men Who Wrote the Book

The "bible" of the air conditioning industry is a 376-page book, entirely devoid of commercialism. In it are clearly explained the terms, workings, and applications of all phases of air conditioning. So helpful and complete is this book—written by Trane Engineers at Trane expense—that it has worldwide use as a standard reference by architects, engineers, and contractors, and also as a text by students of air conditioning.

The same men whose experience made the Trane Air Conditioning Manual possible produce *Engineered Air Conditioning*. It is these men who engineer and build the most complete line of products for air conditioning and heating in the industry—products that are designed and built together for use together, and that reflect the high standards of Trane product engineering.

Because Trane manufactures a *complete* line, architects, engineers and contractors can plan entire Trane systems, obtaining all the necessary elements from one source, with one responsibility. Trane Field Offices in 85 principal cities offer these men their entire cooperation.

* * *

The Convector-radiator—modern successor to the old-fashioned cast iron radiator—has been engineered by Trane for universal application to steam and hot water heating systems, and is being produced in quantity so you can now secure it from local distributors' stocks.

TRANE

Manufacturing Engineers of Equipment for
HEATING AND AIR CONDITIONING

THE TRANE COMPANY, LA CROSSE, WISCONSIN • Also TRANE COMPANY OF CANADA, LTD., TORONTO, ONTARIO

COFFIN TURBO PUMPS

HIGH SPEED • SINGLE STAGE

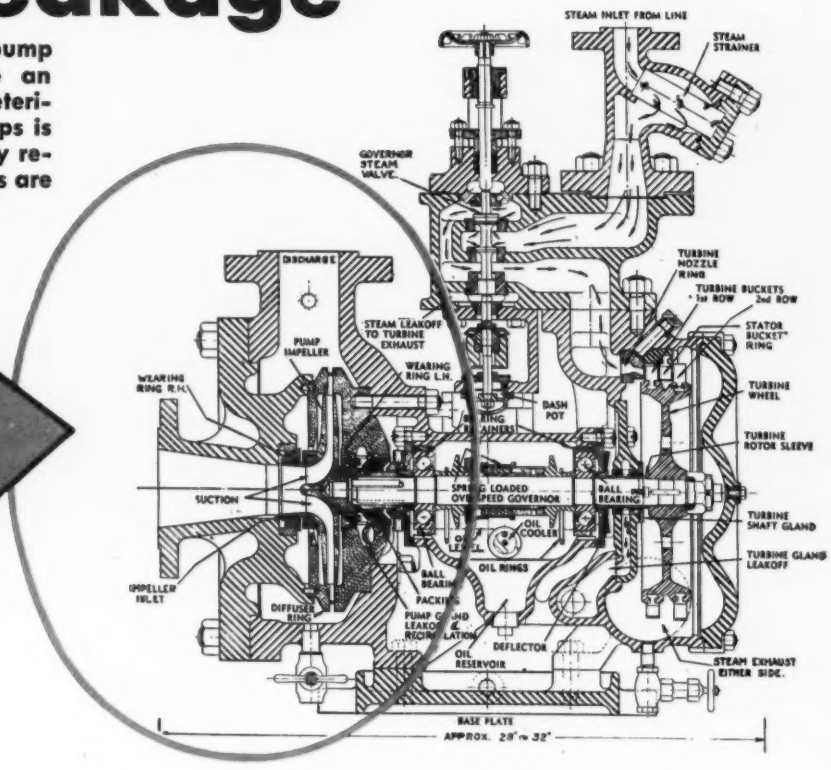
3—No Interstage Leakage

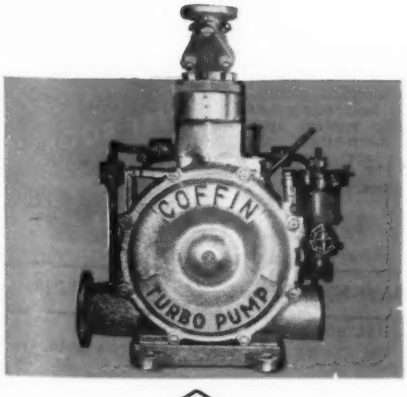
INTERSTAGE leakage in a single stage pump is impossible by definition. Hence an important cause for pressure-capacity deterioration in high pressure centrifugal pumps is ELIMINATED in Coffin designs; and costly replacements of cut or "wiredrawn" casings are never required.

thus

WITH THIS SINGLE STAGE STRUCTURE

there is no interstage leakage!





Standardized Boiler Feed Units for:

Steam Pressures to 650 PSI
Steam Temperatures to 850 F
Back Pressures to 60 PSI

Pump Capacities to 500 GPM
Discharge Pressures to 750 PSI (Heads to 1800 feet)
Liquid Temperatures to 300 F

UNIQUE FEATURES

1. Standardized Steam Turbine Centrifugal Pump and Governor Sets, individually engineered, assembled, and tested . . . for IMMEDIATE SHIPMENT.
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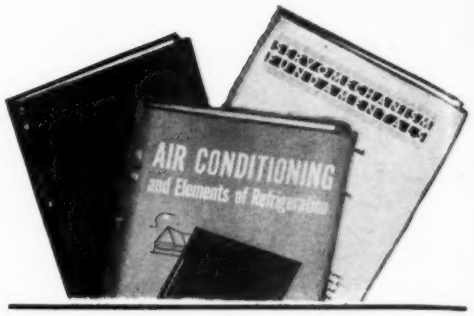

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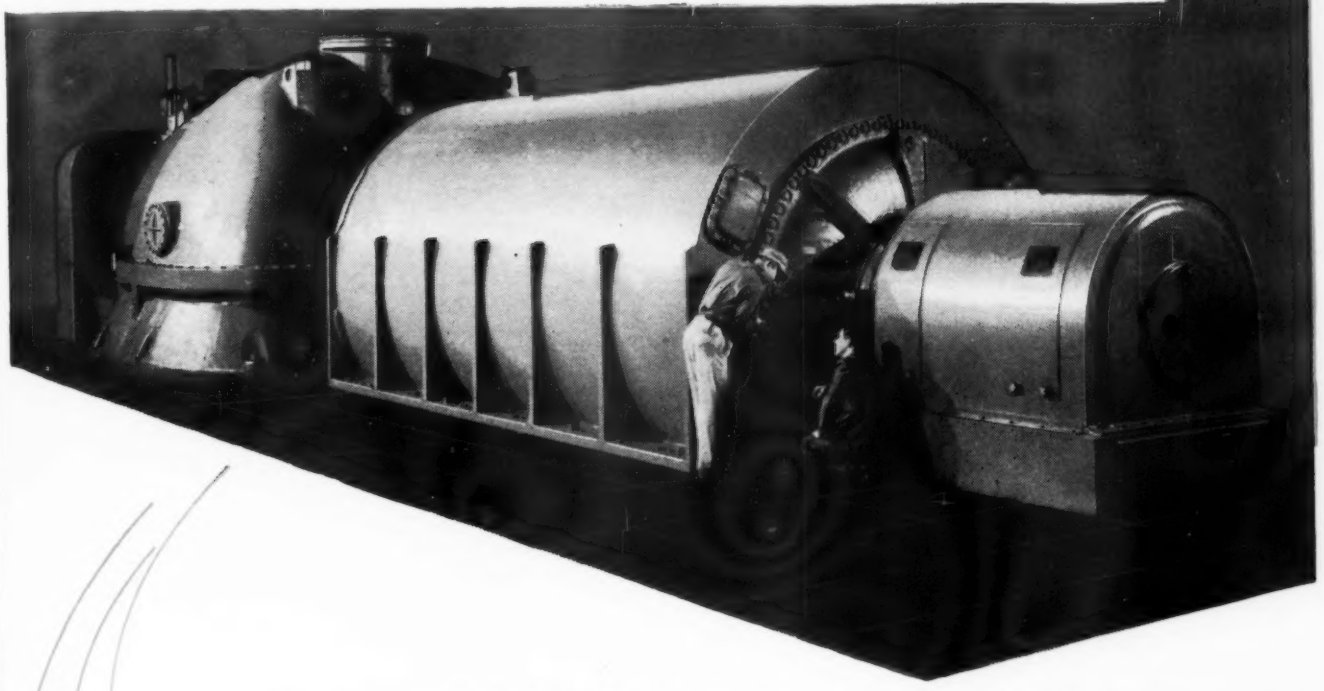

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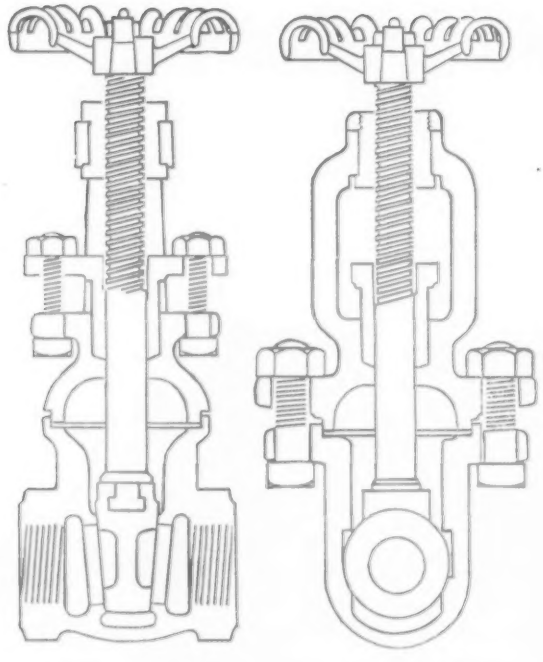

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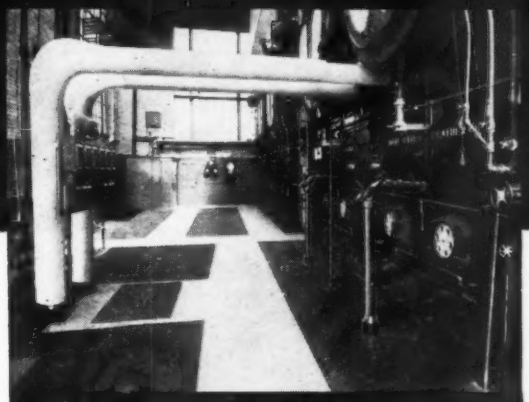

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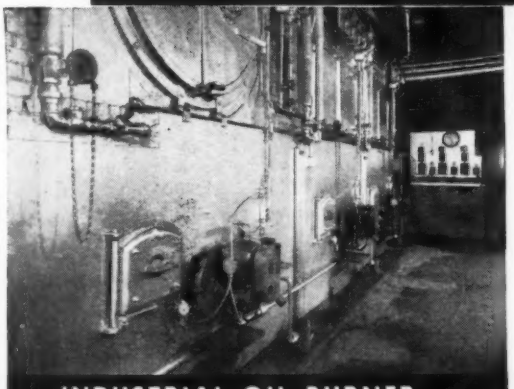

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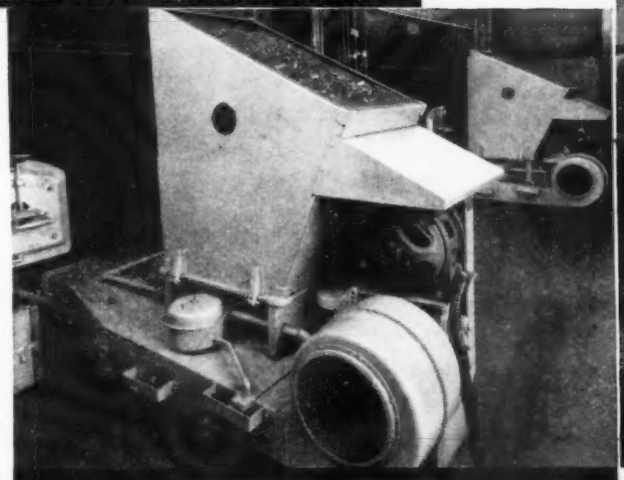

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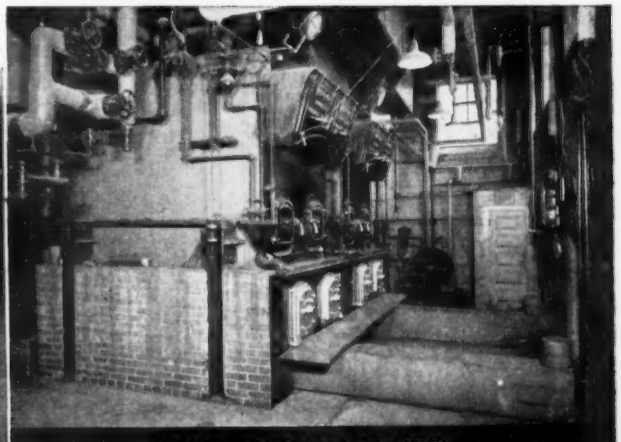

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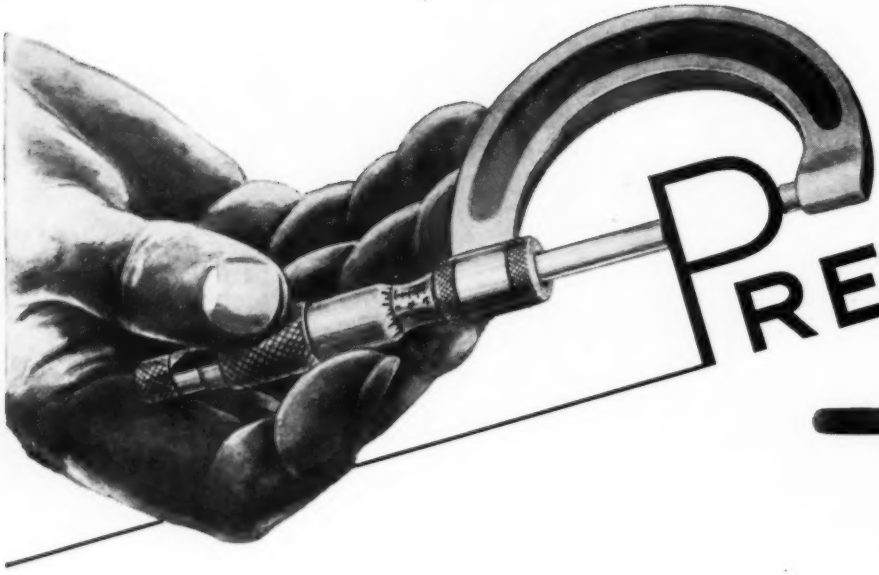

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Fig. 11303 W. E.—Class 1500-pound Cast Steel, Flangeless Bonnet Gate Valve with welding ends. Globe and Non-return Valves are also available in this design

Fig. 9003 W. E.—Class 900-pound Cast Steel Gate Valve. Has welding ends, outside screw rising stem, bolted flanged yoke and taper wedge solid disc.

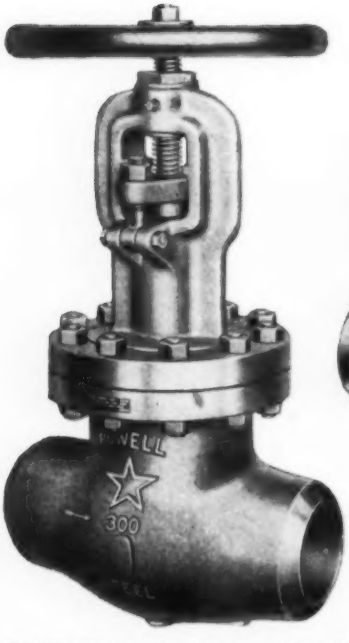

Fig. 3031 W. E.—Class 300-pound Cast Steel Globe Valve with welding ends, outside screw rising stem and bolted flanged yoke.

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Fig. 375—200-pound Bronze Gate Valve with screwed ends, inside screw rising stem, union bonnet and renewable, wear-resisting "Powellium" nickel bronze disc.

Fig. 1793—Large Iron Body Bronze Mounted Gate Valve for 125-pounds W. S. P. Made in sizes 2" to 30", incl. Has flanged ends, outside screw rising stem, bolted flanged yoke and taper wedge solid disc. Taper wedge double discs can be provided in sizes 2" to 12", incl.

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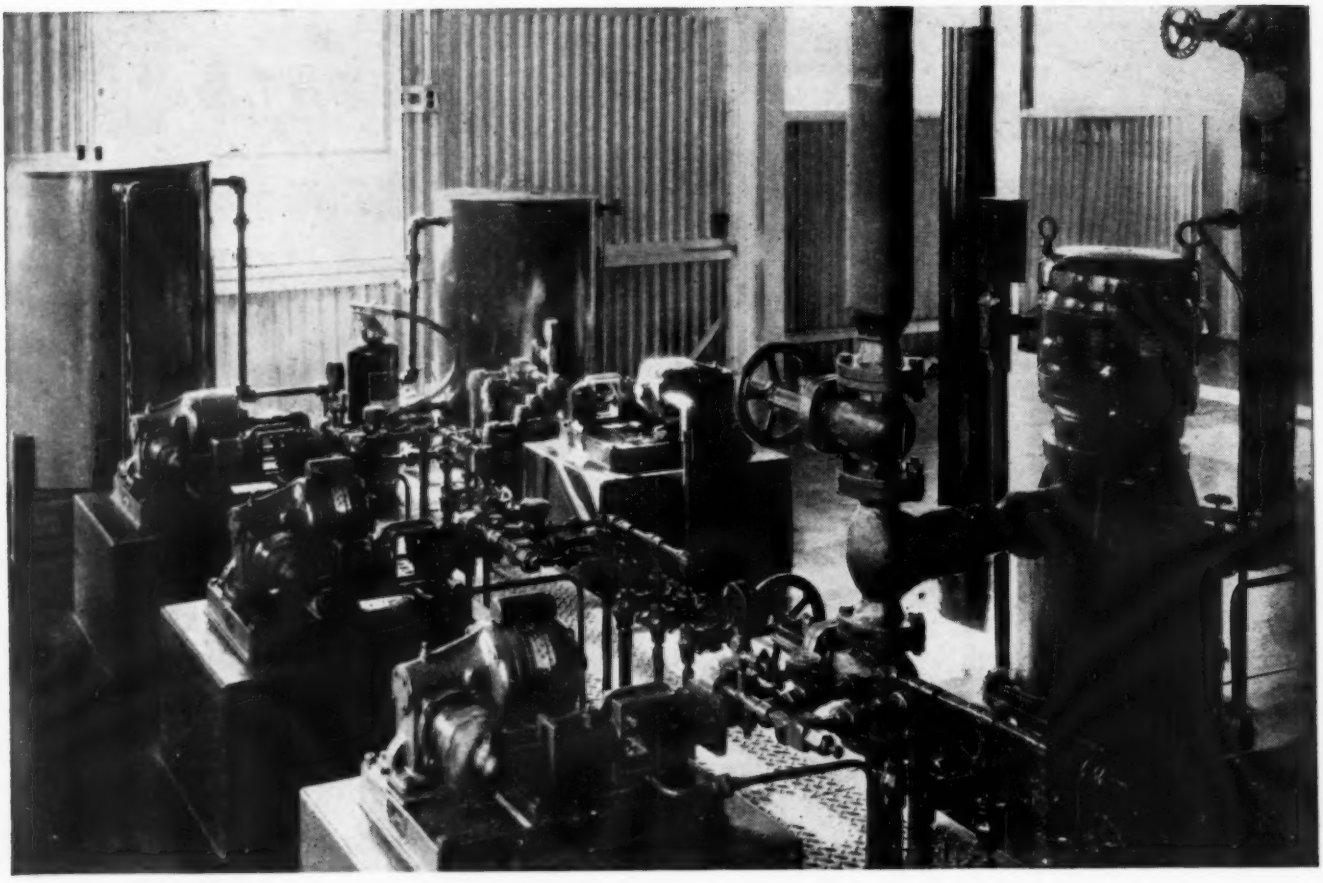

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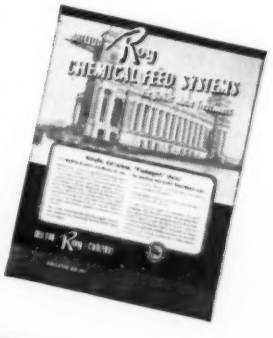

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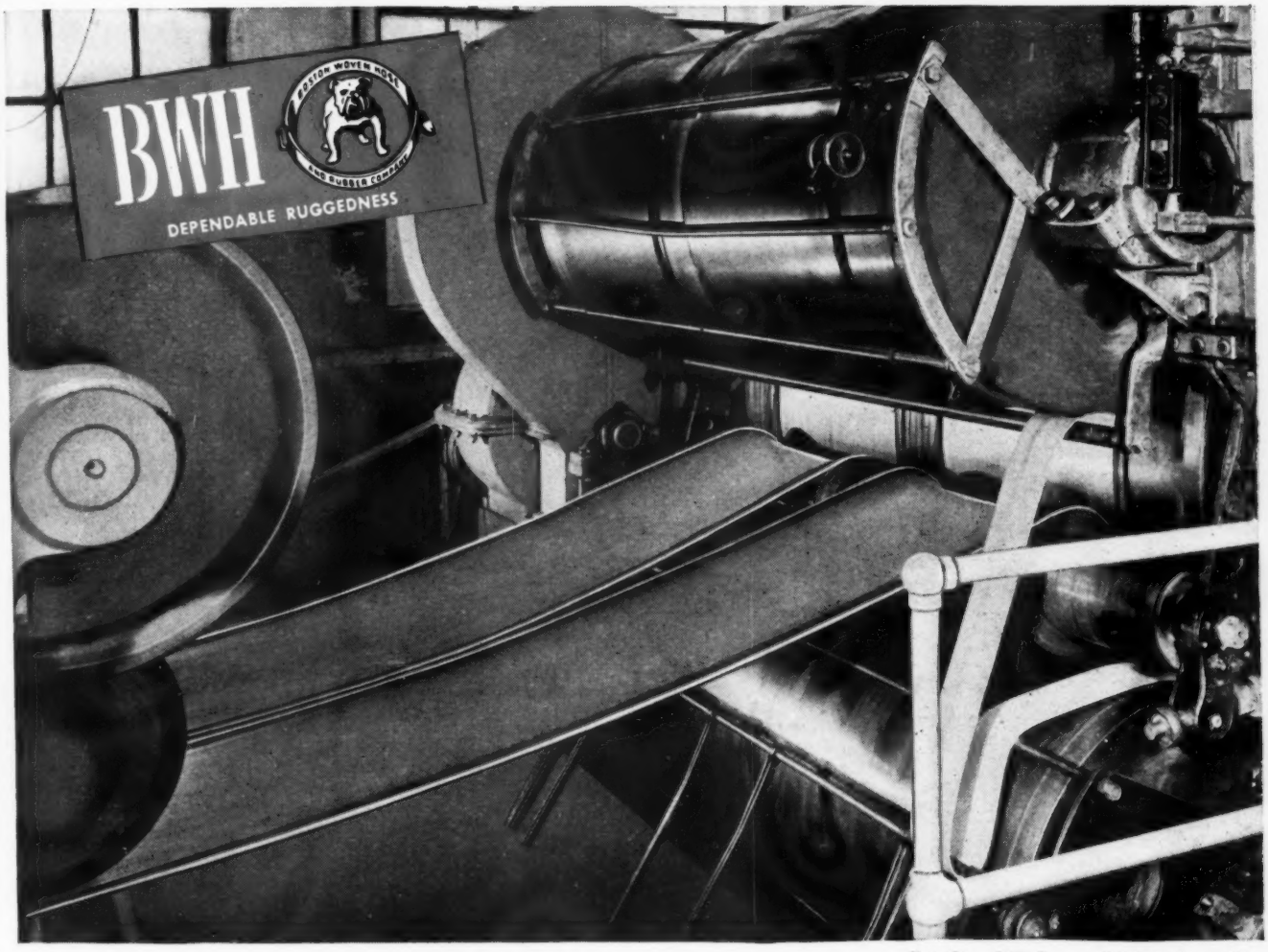

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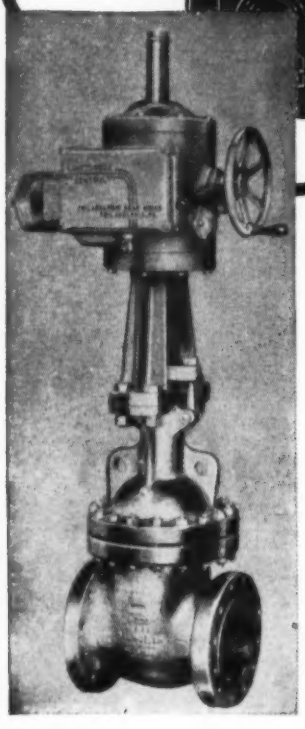

The "Limitorque" (at left) is for valves working at low to medium temperatures, low to high pressures, and normal speed of operation.

This Unit is mounted on top of valve yoke . . . no extra gears, nuts or bearings required. Stem nut is inside and furnished with Unit. Nut is directly inside worm gear which drives it. (All clutches and connecting sleeves are eliminated.)

Limitorque is designed for plug, cock, gate and globe valves . . . Entire Unit and nut can be lifted off valve yoke, by removing flange bolts, without disturbing wiring.

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Torque seating switch insures tight valve closure without strain on valve parts. Protection from damage due to a foreign object obstructing closing is provided, because motor is shut off by thrust exerted on valve disc. Valve is protected during entire closing operation.

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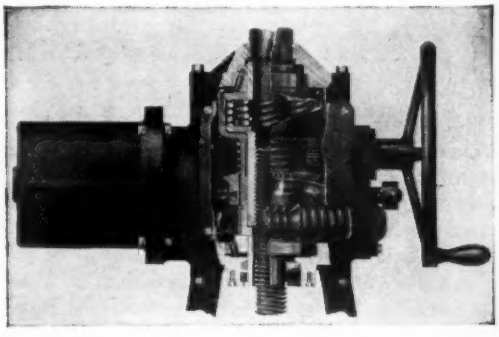
9. Simple valve yoke.
10. Spring compensating mechanism to accommodate physical changes due to temperature variations.

The word "Limitorque" has a definite meaning because an exclusive patented Torque Switch actually limits the torque applied to the operating parts.



Motor is coupled to worm shaft through helical gears. In closing, worm drives worm gear until lugs on the gear meet matching lugs on clutch. Torque is transmitted to the nut through splines connecting the clutch to stem nut. Torque spring is then compressed by axial movement of worm on worm shaft. When torque spring has been compressed to predetermined setting, torque switch is actuated by a tripping collar on worm shaft. This interrupts current to holding coil of controller and stops motor. Inertia of motor is absorbed in further compression of the torque spring. Opening travel is governed by geared limit switch.

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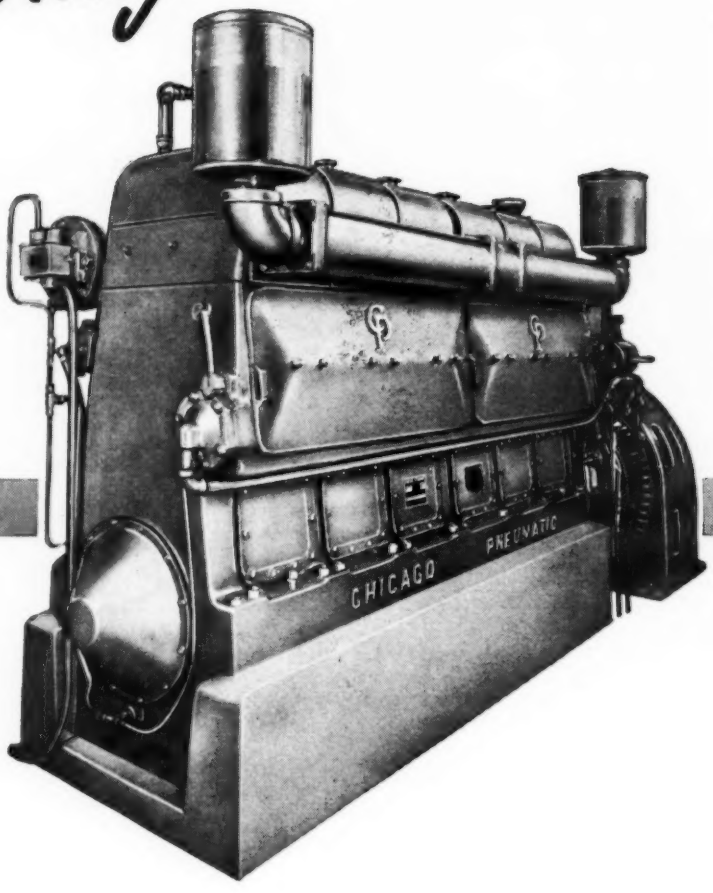

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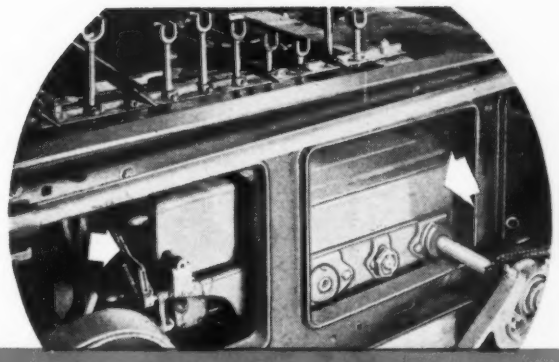

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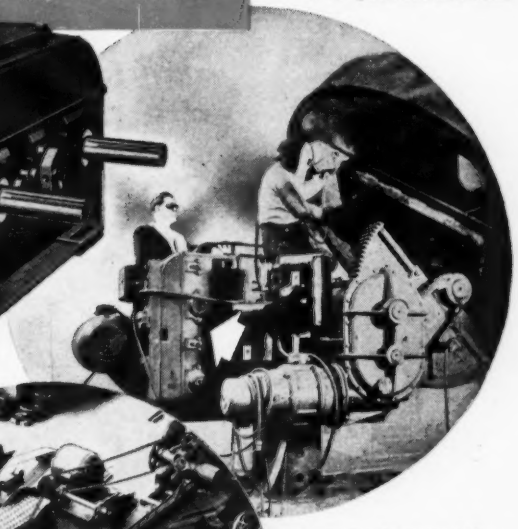
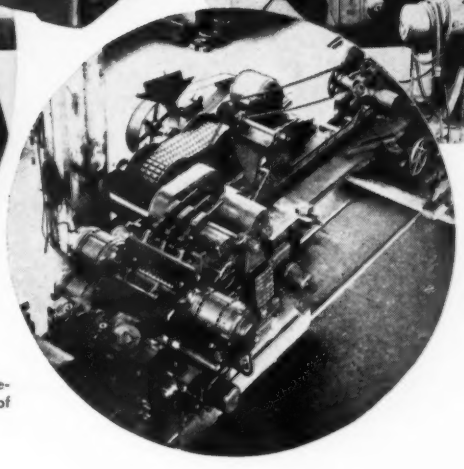
Above: Accurately controls baking time of bread in direct gas-fired tunnel oven.

Above: Maintains constant tension, reduces stretch of yarn on slasher in textile mill.



Above: Varies speed as required in filter processing of synthetic rubber.



Above: Regulates speed of rotary table on welding positioner, for continuous weld.

Left: Provides infinite speed adjustability on lumber planer and matcher.

Provides infinite, accurate speed flexibility within 2:1 to 16:1 ratio

Proved in thousands of installations in scores of industries, REEVES Variable Speed Transmission is the original compact and mechanically correct unit which drives production machines at infinitely variable speeds—making available instantly the most efficient speed for each different operation. It covers the entire speed range smoothly, without steps and without interrupting production . . . maintains any desired speed without fluctuation. Available in sizes fractional to 87 hp, both horizontal (illustrated) and vertical types, either open or enclosed designs. Choice of manual (handwheel), electric remote (push button) or entirely automatic controls.

Also in the complete line of REEVES Speed Control equipment are two other basic units—the Motodrive and the Vari-Speed Motor Pulley—likewise offered in the widest selection of designs, sizes, speed ratios and controls.

By providing the right speed for every job, under every changing condition, REEVES Speed Drives are assuring better quality products, higher rates of production and lower manufacturing costs in more than 260,000 widely diversified industrial installations and as standard equipment on more than 2,100 different makes of machines.

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The exacting job we refer to is making the kind of pressure gauges needed in every phase of industry. We have made this *our* job, and we have handled it so well that the resulting preference accorded Marsh instruments has built a volume of business which called for this new, modern plant at the North edge of Chicago, in Skokie, Illinois.

Marsh alone has the "Recalibrator" — quickest and best way to correct a gauge that has been knocked out of adjustment by improper handling.

We have built this plant on the bed rock foundation of more than 80 years of instrument making, but we have taken full advantage of the opportunity of building anew. Thus, we have put into it every available tool of production to expedite and amplify the methods and facilities and craftsmanship which have made Marsh instruments "The Standard of Accuracy."

There are new facilities here for carrying out the many extra steps that have contributed so much extra value to all Marsh instruments—new facilities for the testing of materials, for the gauging of component parts, for the final testing of every Marsh product.

Yes, the finest of pressure gauges are being made still better in the new Marsh plant. Insist on Marsh accuracy and stamina when you select pressure gauges—or equipment requiring gauges.

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It takes a pressure gauge to tell you what's going on inside that boiler, tank, compressor, pump or similar equipment — and a good one to tell it right. Those who know pressure gauges best, insist on Marsh instruments . . . well confirmed by the preference accorded Marsh gauges as original equipment by manufacturers of boilers, hydraulic machinery, compressors, refrigeration equipment, food processing machinery, and equipment for the petroleum industry.

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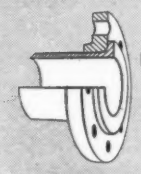
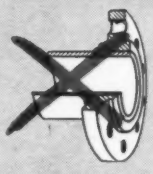
"THE STANDARD OF ACCURACY"

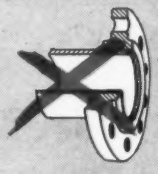
WHEN YOU NEED Lap-Joint Stub Ends



LAP-JOINT STUB END



SCREWED AND WELDED FLANGE



SLIP-ON WELDING FLANGE

WELDING NECK FLANGE

Whenever a flanged joint is required, the lap-joint stub end has a great advantage over flanges welded to the pipe. The swivel flange makes it unnecessary to accurately line up the bolt holes before welding: "setting up" is simple and quick because no special clamps or jigs are required to hold the face of the flange absolutely perpendicular to the axis of the pipe. The result is a real saving in time and cost of welding. Field crews report a saving of 25% in erection time for making up a joint using Midwest Lap-Joint Stub Ends in comparison with flanges rigidly fixed to the pipe.

Specify MIDWEST FOR THESE REASONS

FORGED LAP—by special Midwest process that simultaneously upsets pipe and forms lap. Tests prove superiority of process.

LARGE RADIUS FILLET—More metal, hence greater strength, in the critical area of lap where maximum total bending and shearing stresses occur.

HEAVY LAP—After machining front and back, lap is always at least equal to pipe wall thickness.

STRESS RELIEVED—Metal in lap is worked at forging heat, then normalized to assure uniform, close grained structure. Photo-micrographs frequently show it to be superior to original pipe metal.

SQUARE CORNER—(instead of a round corner) adds to lap strength and eliminates pock-ets for accumulation of con-densate and sediment which promote corrosion.

MACHINE BEVELED—welding end is accurately machined for easy welding.

PHONOGRAPHIC FINISH—of lap face to hold gasket more securely.

UNIFORM FLANGE BEARING—Back face of lap carefully machined to assure uniform flange bearing nec-essary to satisfactory joint.

TIME SAVED—In welding and erection because bolt holes need not be carefully lined up before welding.

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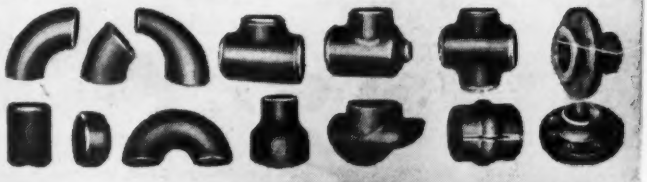
Distributors in Many Cities.

MIDWEST WELDING FITTINGS IMPROVE PIPING DESIGN AND REDUCE COSTS



COPPER ALLOY BULLETIN

MARINE AND POWER EDITION

REPORTING NEWS AND TECHNICAL DEVELOPMENTS OF COPPER AND COPPER-BASE ALLOYS

Prepared by Bridgeport Brass Company "Bridgeport" *Headquarters for BRASS, BRONZE, and COPPER*

Preventing Steam Erosion of Condenser and Heat Exchanger Tubing

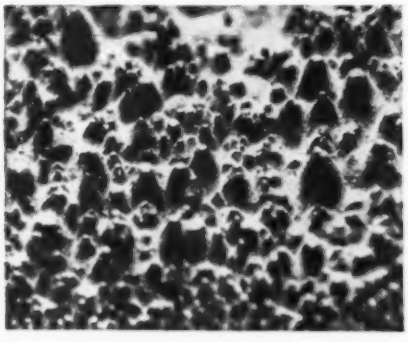
Copper-base alloy condenser and heat exchanger tubes are giving very satisfactory performance in steam service. Occasionally, however, steam erosion is encountered on the tubes facing the steam inlet in the condenser or heat exchanger.

With dry steam or in regions of low steam velocity, such as at the bottom of the unit or in the center of the tube bank, steam erosion is no problem. Where no steam erosion occurs, the rate of corrosion on the steam side is extremely low, averaging less than .0001 inches per year.

If, on the other hand, the velocity of the steam is high and it also contains a certain amount of moisture, it has an erosive action when it impinges on the tube surfaces. In extreme cases steam erosion has been known to cut through the tube wall in a very spectacular fashion.

Engineers and maintenance men are familiar with the erosive effect of high velocity steam on valves. The smooth grooves which result are often referred to as "wire drawing". Tubes of copper, brass, bronze, copper-nickel or stainless steel, may be steam-eroded at rates varying from .001 inches to .050 inches or more per year, depending upon the moisture content of the steam, the number and size of water droplets it contains as well as its velocity and composition. Usually, the tubes affected are those which face the steam inlet at the top of the condenser.

Steam erosion produces a characteristically roughened surface which appears to be made up of tiny cones tilted in one direction when viewed under the microscope. These tilted cones are caused by steam striking the tubes at an angle. Sometimes the tips of the cones do not develop fully and the eroded surface may be covered by minute cones with rounded tops.



Photomicrograph showing tilted cones formed by steam erosion of copper tubing. Tops of cones represent original surface. Mag. 10X.

Preventing Steam Erosion

Numerous attempts have been made to minimize the effects of steam erosion on condenser and heat exchanger tubing. The following measures have been found very effective in most cases.

1. Remove as much moisture as possible from the steam before it reaches the unit.
2. Keep the steam velocities as low as possible.
3. Install a baffle plate to protect the tubes from direct impingement. Such procedure has the additional advantage of preventing or minimizing forced tube vibration brought about by impact of the pulsating steam at high velocity. Reducing vibration helps to reduce premature tube failures due to corrosion fatigue cracking, which is most prevalent in that part of the condenser where the tubing is exposed to the full force of the incoming vapor. (See Copper Alloy Bulletin, Marine and Power Edition, May, 1947.)
4. Worn tubes are sometimes protected by metallizing with a stainless steel coating.
5. Another procedure which holds great possibilities is the use of Duplex tubing, made up of a copper alloy to the water side and stainless steel to the steam side. Here, advantage can be taken of the better resistance of stainless steel to steam erosion, and the superior resistance of the copper-base alloy to corrosion from sea water, boiler feed water and condensate.
6. Maintain a high quality of steam at all times. Although, to the best of our knowledge, very little has been published on this subject, experience would appear to indicate that composition also plays an important part in steam erosion. Quality of the steam can be maintained by proper control of the boiler feed water composition. This can be accomplished through the use of chemicals and by evaporators which remove objectionable dissolved and suspended solids from the boiler feed water. (See Copper Alloy Bulletin, Marine and Power Edition, February, 1948.)

Laboratory Service

Bridgeport's laboratory stands ready to render assistance in connection with problems involving condenser and heat exchanger tubing. Over a period of many years, Bridgeport has accumulated a wealth of information as a result of consistent corrosion research; working with many condenser tube users; and conducting extensive field and service tests. This information is available to condenser tube users.

Get in touch with the nearest Bridgeport office for laboratory service, and write for your copy of Bridgeport's 120-page Condenser Tube Manual, which contains much valuable information about condenser tube alloys, corrosion research, methods of installing, specifications and other data.

Copper Tubing Has Many Advantages In Marine and Power Applications

Copper tubing, because of fine corrosion resistance, ability to withstand vibration and considerable internal pressure, as well as ease of installation, is widely used in land power stations and on board ship. Typical applications are hot and cold water lines, refrigeration lines, compressed air lines and condensate piping, auxiliary steam lines, steam drain collection systems, as well as in evaporators and various types of heat exchangers. Copper tubing is also used in lubrication systems for conveying oil from machinery to settling and purifying tanks.

With initial installations of copper tubing, savings are realized in labor because solder-type fittings are more easily and quickly installed than threaded connections, and because elbow fittings are eliminated, since soft copper tubing can be bent right on the job. Savings of one-third to one-half in weight and space are possible because smaller sizes and lighter wall thicknesses can be used. Copper tubing offers less friction than rustable pipe. Also, since copper tubing does not become clogged with corrosion products generally formed by rustable materials, no allowance need be made for extra inside diameter. In addition, threading reduces the wall thickness of pipe by as much as a half, and leakage frequently occurs first in a threaded section. With copper tubing, no reduction in thickness takes place, and correspondingly lighter gauges can be used. When alterations are made, copper tubing can be used over and over again without loss, since the lines are easily removed by heating the solder fittings and pulling the tubing free.

For high pressures, Navy-type copper tubing is available in several wall thicknesses for connecting with "Walseal" type fittings.

Bridgeport's 64-page booklet, "Water Pipe Sizes", contains much valuable information about copper tubing, as well as brass and copper pipe. Write for your copy.

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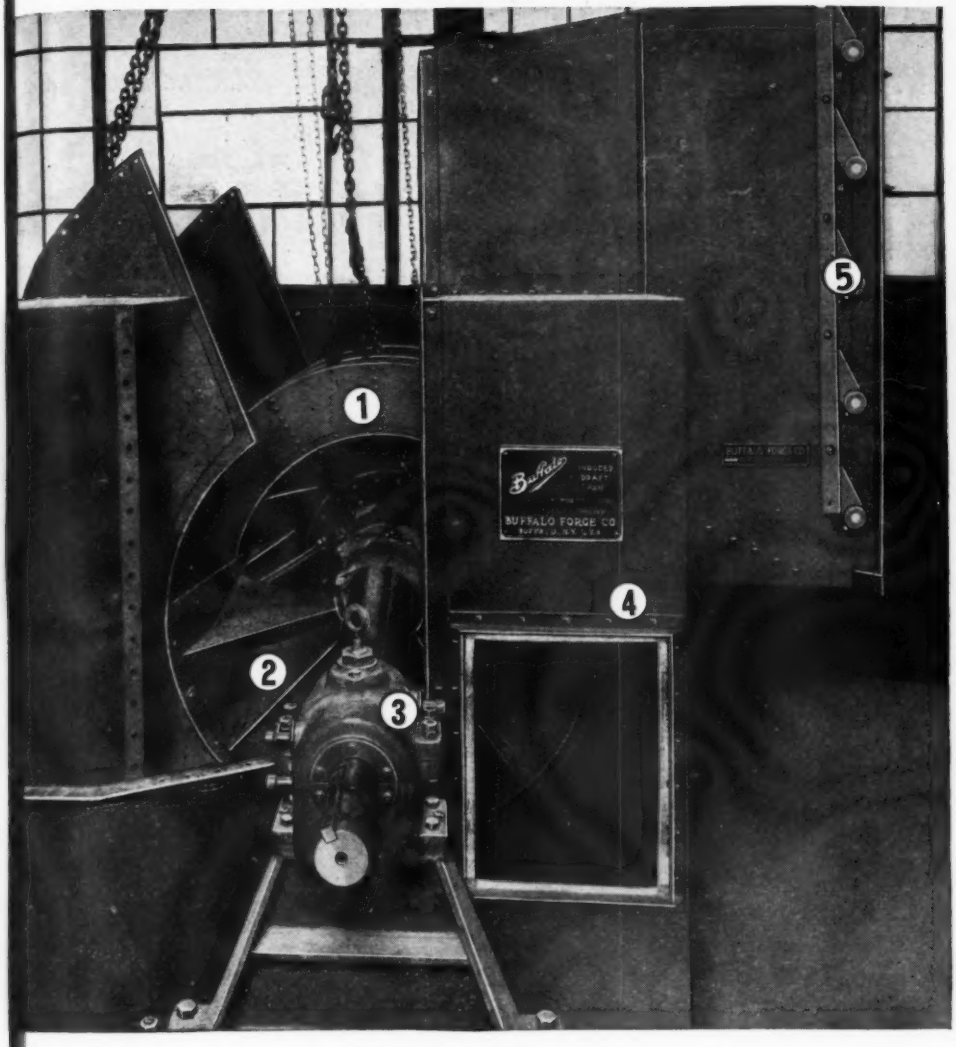

FANS by "Buffalo"

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CREASED BENDS
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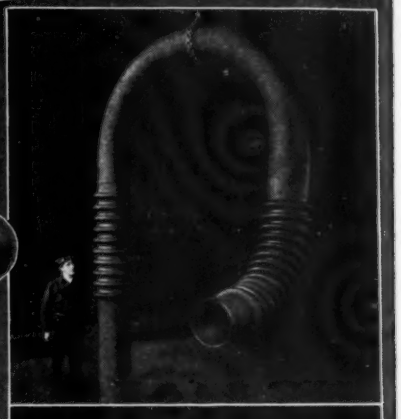

REDUCE STRESS

IMPROVE OPERATION

A P. P. & E. Corrugated Tangent has much more flexibility than a straight pipe of equal length, diameter, and wall thickness. A creased bend maintains full wall thickness on the outside of the bend.

This inherent flexibility minimizes movement caused by thermal expansion. It makes practicable the use of shorter radius bends, with full wall thickness, without causing excessive end reaction against equipment. It also makes possible higher head clearances, more easily accessible valves, and more convenient location of auxiliary equipment.

Creased Bends and Corrugated Tangents can be prefabricated by us in any practical design. This is an important feature, since the characteristics of this type of piping often permit installation of a more complex system in an existing structure, thus avoiding need for constructing or enlarging a building. Consult our nearest representative.

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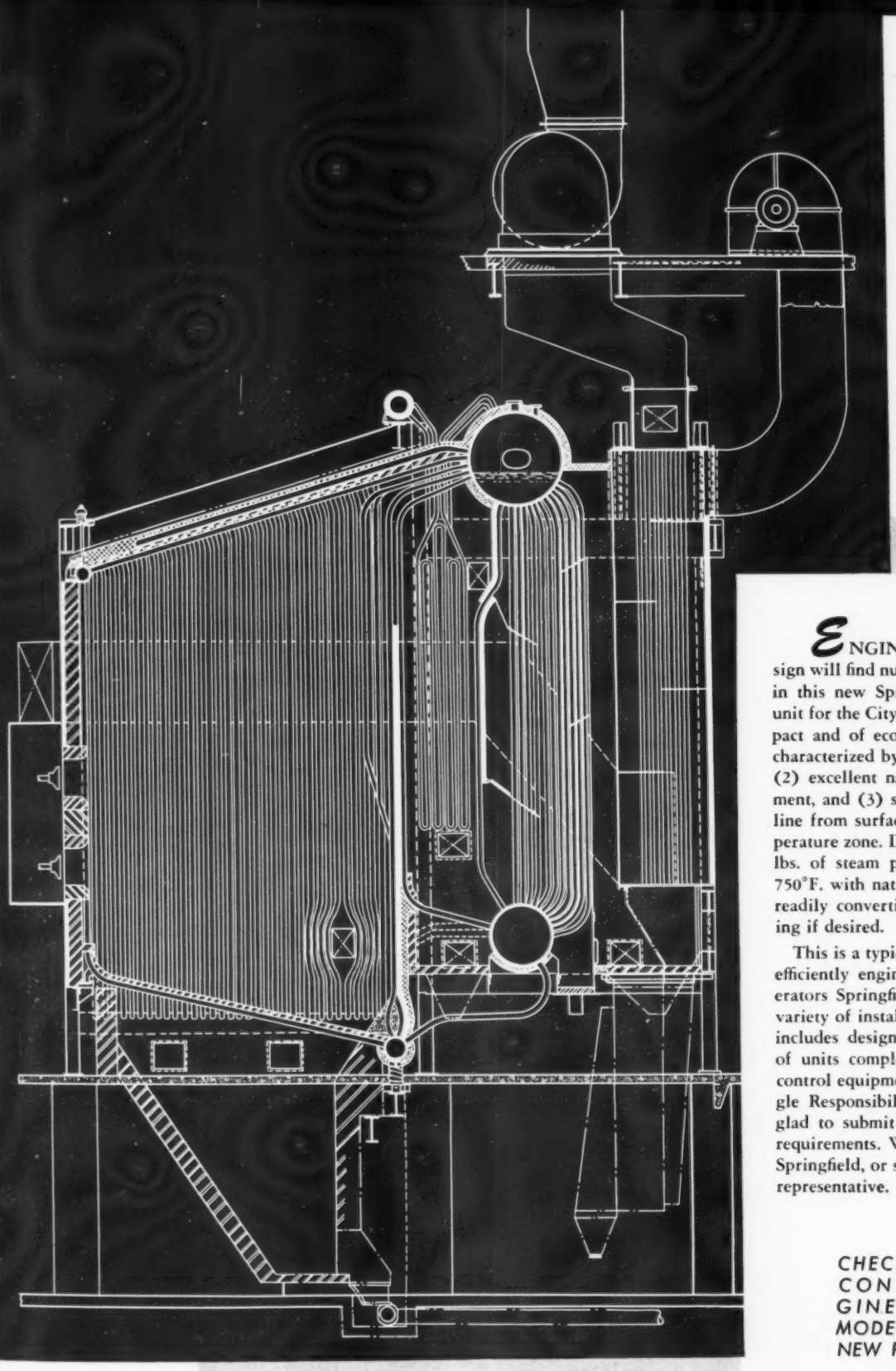

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This is a typical example of the modern, efficiently engineered, 2-drum steam generators Springfield is building for a wide variety of installations. Springfield service includes design, fabrication, and erection of units complete with firing, draft, and control equipment—all taken under a "Single Responsibility" contract. We will be glad to submit a proposal covering your requirements. Write to our main office in Springfield, or see your nearest Springfield representative.

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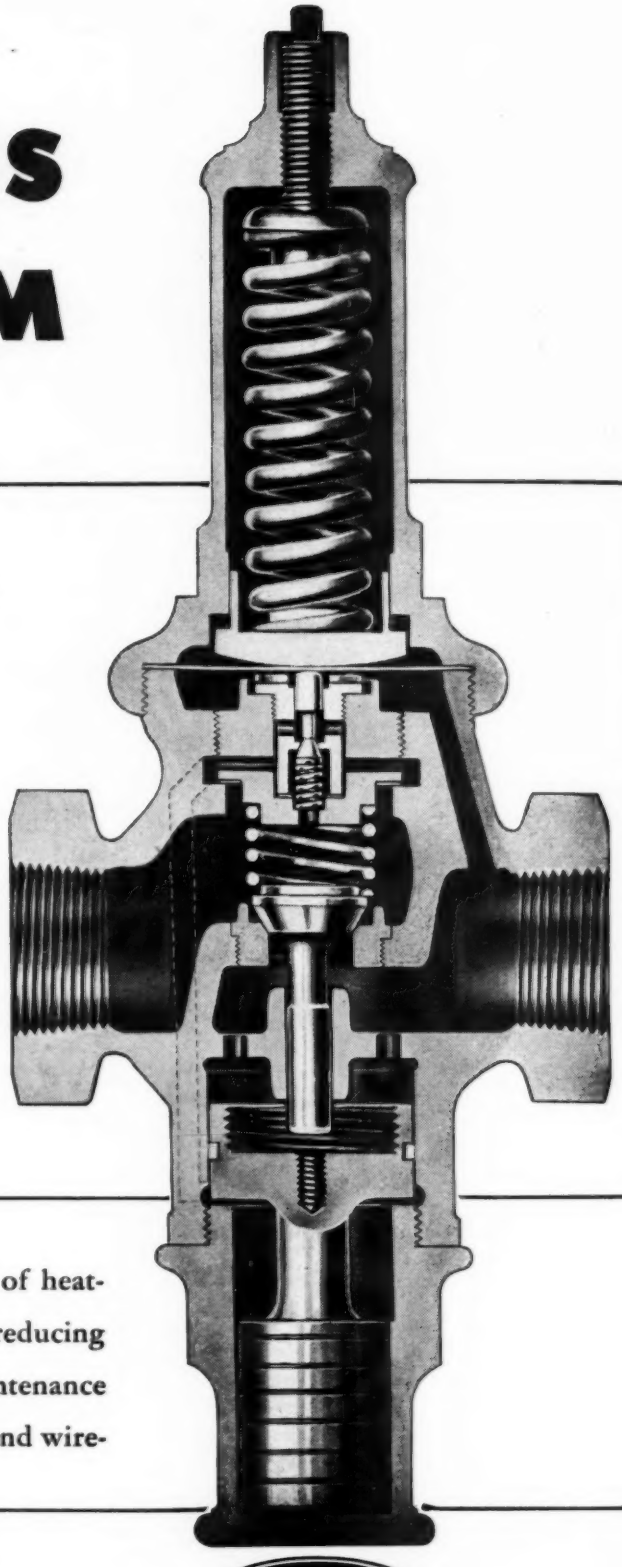
MASONEILAN No. 11 Reducing Valves



Because the pilot, valve and seats are made of heat-treated stainless steel, Masoneilan No. 11 reducing valves give accurate long life and reduce maintenance by minimizing valve sticking, steam-cutting and wire-drawing. And remember this stainless steel trim is standard . . . costs you no more. Investigate and install Masoneilan No. 11. These regulators will save you money by staying in service longer. Write for catalog, today.

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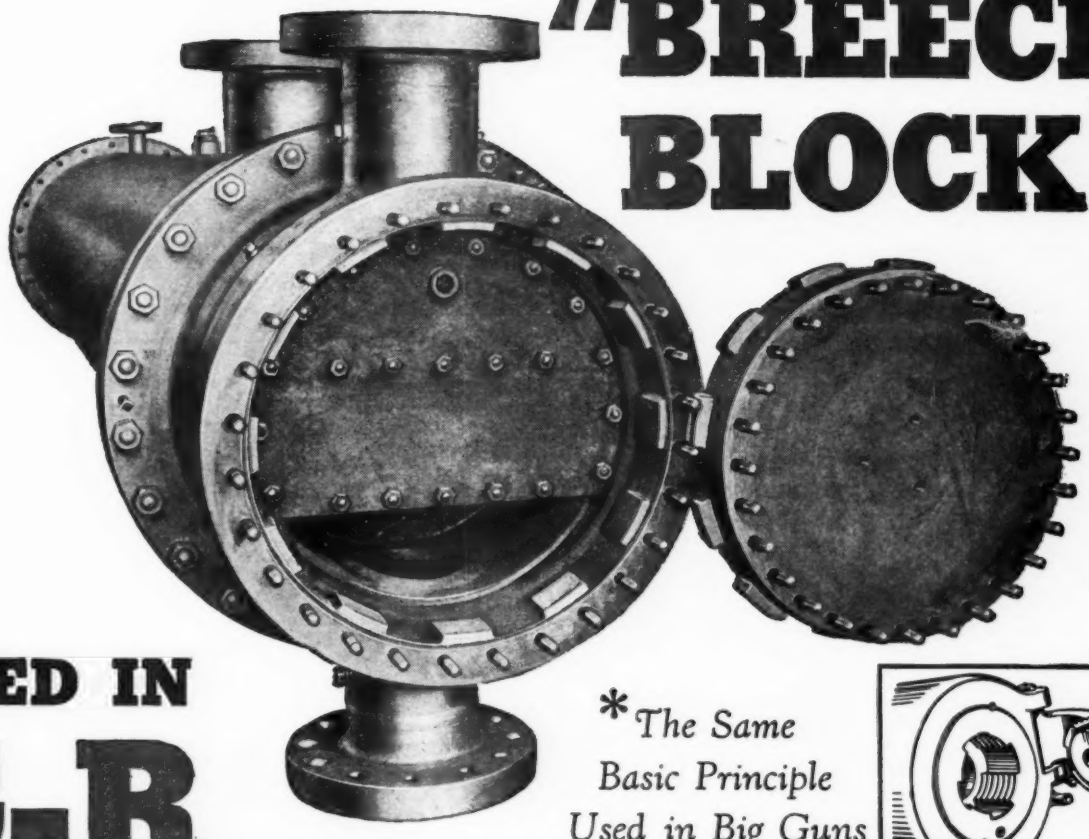
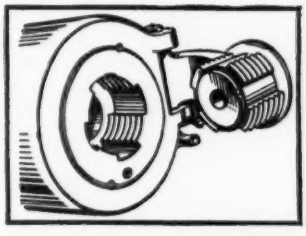


USED IN G-R HIGH PRESSURE BLEEDER HEATERS

*The Same Basic Principle Used in Big Guns



NOTE THESE ADDITIONAL G-R BLEEDER HEATER FEATURES

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PARTITION SEALING PLATES

. . . prevent leakage between passes at the water heads without requiring stay bolts.

•

ENVELOPING STEAM BAFFLE

. . . permits water outlet temperatures beyond saturated steam supply—when sufficient superheat is available.

•

TUBE JOINTS

carefully prepared and controlled, assuring lasting tightness of the tube ends in the tube sheets.

The effectiveness of this simple arrangement is known to every one who has seen a big gun fired.

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• The inner circumference of the head and the periphery of the cover have projections of corresponding size. When the cover is inserted and revolved a few inches, these projections engage with each other so as to lock the cover in place. The hydraulic load is carried in this manner.

• The pressure-sealing gasket is *outside* of the cover . . . located where any seepage is immediately visible, and accessible for tightening without dismantling or disturbing the waterhead cover.

• At the floating head, a shell test pressure can be applied without fear of gasket failure.

This exclusive seal and the many other special features of G-R Bleeder Heaters warrant your further investigation. Write for Bulletin 278 describing these units in detail.

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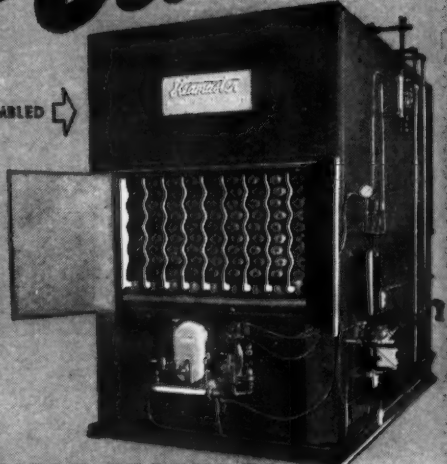

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- ☐ Can Be Fired Over Rated Capacity and still maintain high thermal efficiency.

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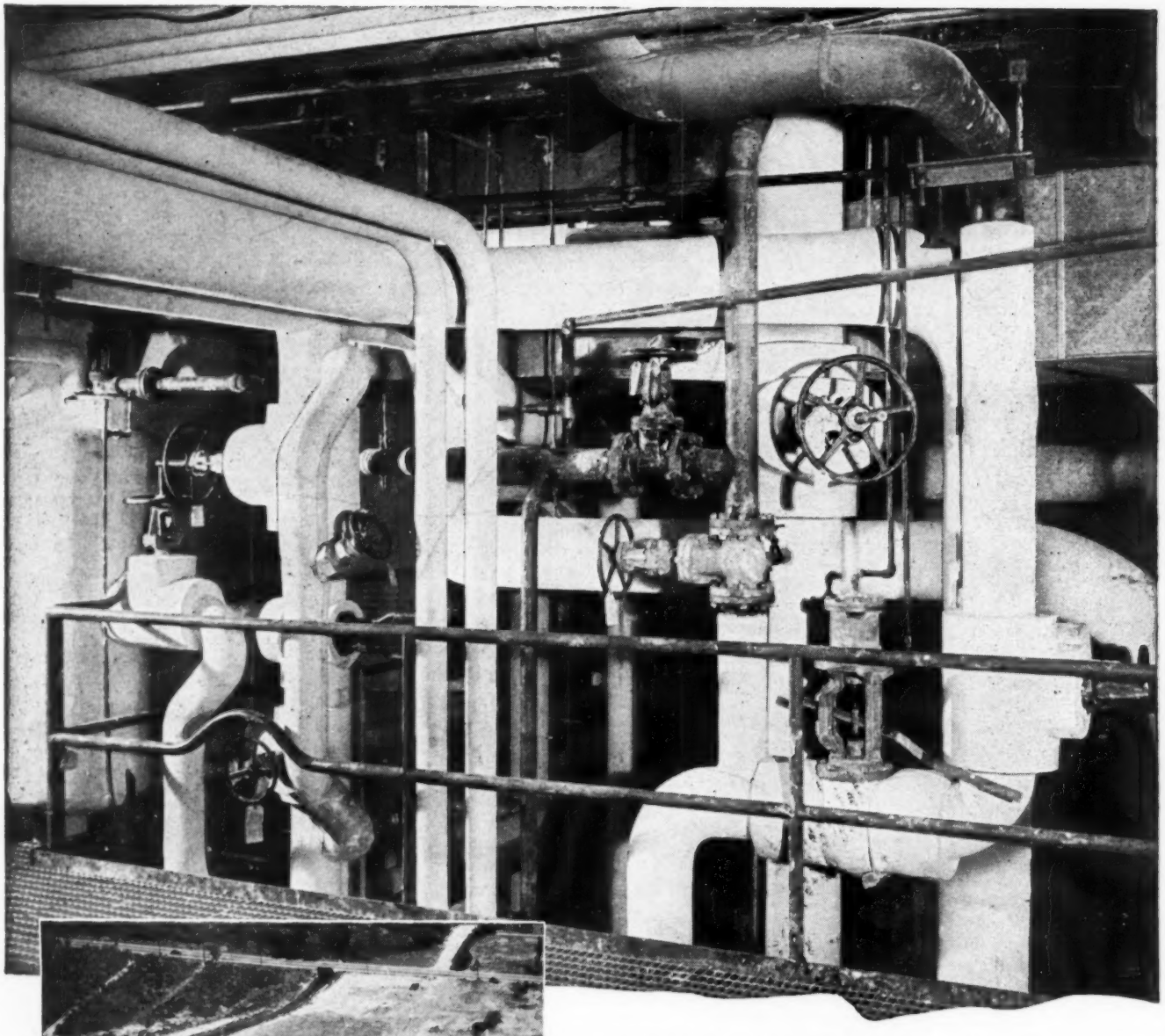

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You get longer life with capacity loads when you use this belt

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1 High-tensile duck plies are securely bound by first quality, moisture-resistant friction and skim coat to insure desired flexibility with necessary toughness.

2 Tough rubber-compound cover protects inner structure against abrasion, cutting and damaging chemicals.

3 Special construction does away with all inside folds, thus assuring efficient and economical service.

4 Special treatment protects entire belt carcass from mildew.

5 Belt is stretched and vulcanized into a solid, sturdy unit to protect inner structure against penetration by deteriorating materials.

HEWITT RUBBER DIVISION, HEWITT-ROBINS INCORPORATED · MAKERS OF INDUSTRIAL HOSE • BELTING • PACKING

see exactly what is happening beyond range of vision . . . around corners . . . through walls

The Diamond "Utiliscope" uses television to provide a clear, exact picture of something currently taking place at a remote or inaccessible point.

For example, in the Hell Gate Station of Consolidated Edison, New York City, it brings to the control room the instantaneous and unmistakable image of the water level in a boiler water gauge that is 8 floors above and 325 feet away in another building.

A continuous picture is produced by 60 individual image fields each second (sound motion pictures have only 48 per second). Every change in whatever is viewed is reproduced faithfully and instantly . . . there is no measurable time lag.

Construction is simple and rugged . . . the Diamond "Utiliscope" has fewer tubes than a good radio set and is built for continuous operation at temperatures up to 150° F. Installation requires no special skill; instructions can be followed by anyone using ordinary care.

Exceptional stability is another important characteristic of the "Utiliscope". This permits simplification of control to the point where only a screw driver is needed for adjustment of focus, brilliance and contrast to suit individual preference.

If you must see *exactly* and *instantly* something that is happening beyond the range of vision, around corners and through walls . . . or that is perilous to human life to observe directly . . . the "Utiliscope" is probably the answer to your problem. Ask for Bulletin No. 1013.

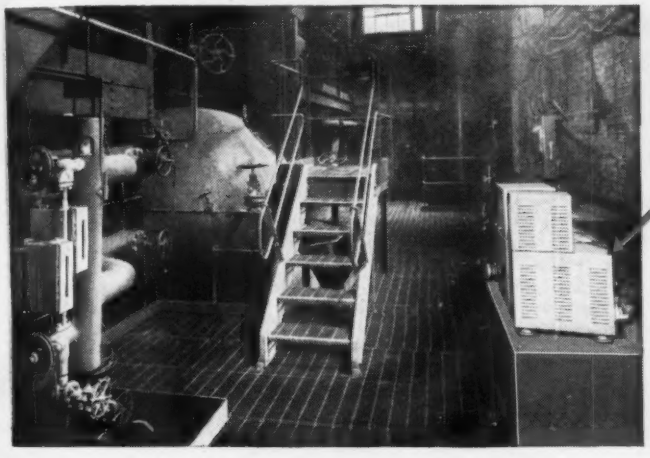
For exactly, simultaneously and continuously picturing at a remote point . . . an object, operation or condition

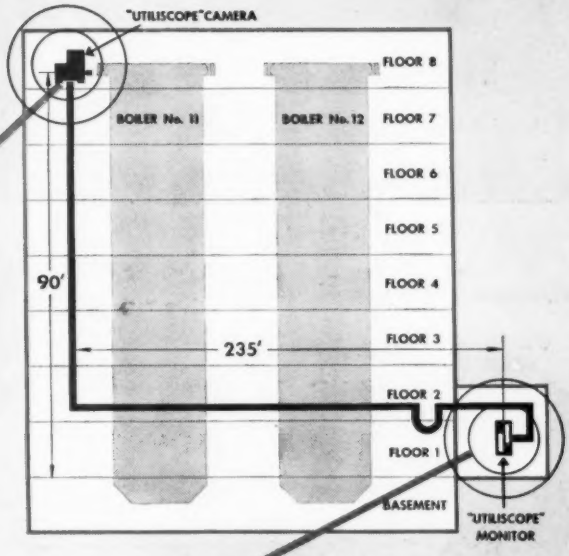
The "Utiliscope" was developed jointly by the Farnsworth Television & Radio Corporation and the Diamond Power Specialty Corporation.

DIAMOND POWER SPECIALTY CORP. • Detroit 31, Mich.

with the DIAMOND "UTILISCOPE"

(TELEVISION IN INDUSTRY)





(Above) "Utiliscope" camera scans water level gauge of Boiler No. 11 at Hell Gate Station of Consolidated Edison in New York City. Eight floors below and 325 feet distant, the "Utiliscope" monitor (viewer) is mounted in the instrument panel in the control room. Small changes in water level are immediately apparent to the operators at all times.

OTHER USES

To observe radioactive materials behind barriers.

To reproduce images of maps, charts, etc.

To observe coal feed to pulverizers or stokers.

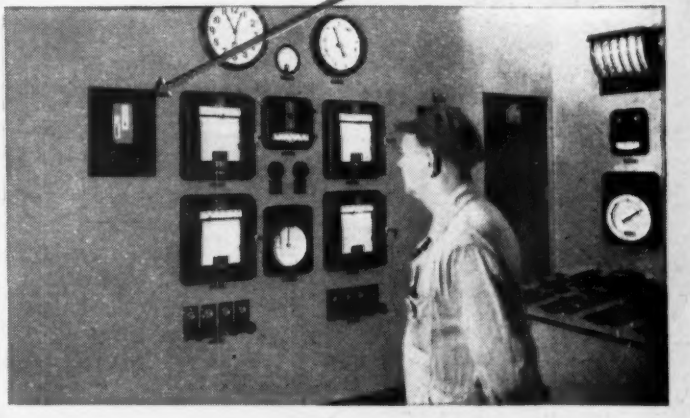
To observe burner ignition, secondary combustion, slag flow, etc.

To observe presence of smoke from stacks.

To reproduce readings of electric meters, liquid level or temperature gauges, etc. located at remote or inaccessible places.

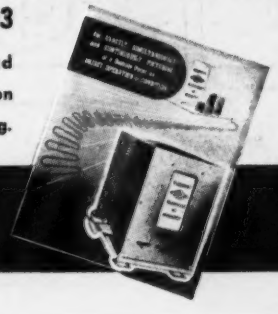
To observe conditions in steel furnaces.

"Utiliscope"—Registered U. S. Patent Office



WRITE FOR BULLETIN No. 1013

This bulletin illustrates the Diamond "Utiliscope" and describes its operation in detail. A copy is yours for the asking.

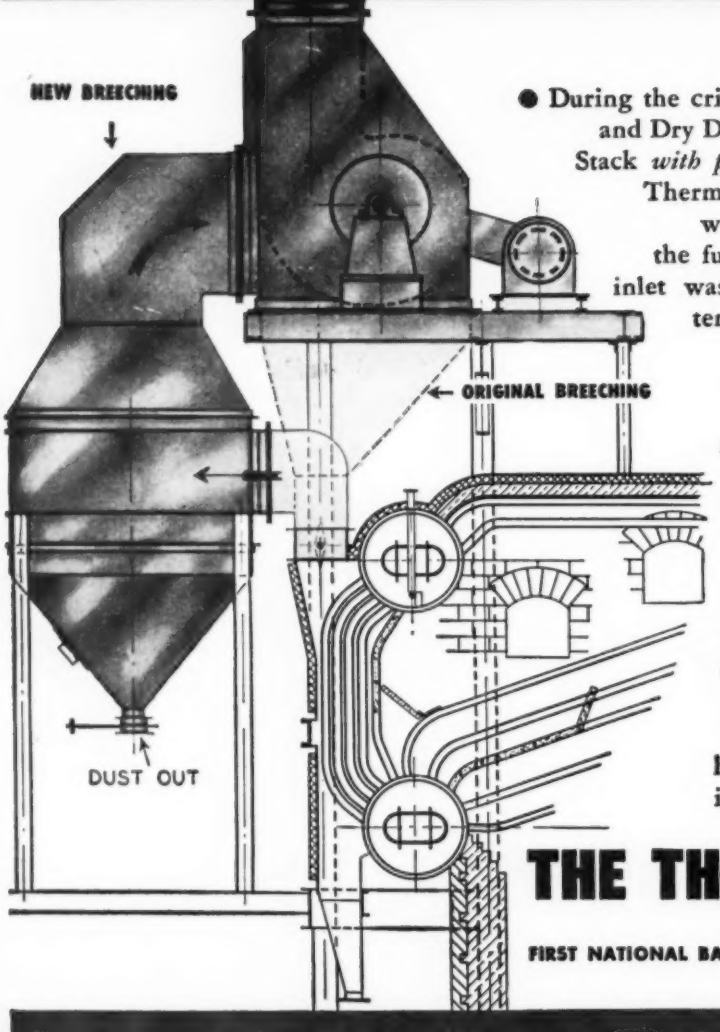


DIAMOND SPECIALTY LIMITED · Windsor, Ontario

The Federal Shipbuilding and Dry Dock Co.

ENGINEERED for the FUTURE

—Have You?



● During the critical shortage of steel, the Federal Shipbuilding and Dry Dock Company of New Jersey installed a Thermix Stack *with provisions for a dust collector at a future date.* A Thermix Fan Stack with both a side and bottom inlet was used. The side inlet was blanked off for use in the future installation of the dust collector; the bottom inlet was directly connected to the boiler outlet. This temporary breeching, from the boiler to the ID fan, is indicated in the illustration by dotted lines.

Now that steel is available, the Thermix Tubular Dust Collector has been added to the original stack installation. Placing it in operation necessitated only the removal of the duct from boiler to stack and connection of collector to boiler and side inlet of the fan. The original bottom inlet of the fan was then blanked off.

Thermix collectors have the distinct advantage of both flexibility and extremely high collection efficiencies over a wide range.

Call on our project engineers, the Thermix Corporation, for more detailed information on how your plant equipment can be designed and installed to permit future additions.

THE THERMIX CORPORATION

Project and Sales Engineers

FIRST NATIONAL BANK BLDG. **GREENWICH, CONN.**

PRAT-DANIEL CORPORATION

EAST PORT CHESTER, CONN.

It grows on you!

Here's a switchboard designed so that it can *grow with you.*

That's right. Trumbull switchboards may be expanded easily and economically to meet your electrical requirements. Standard panels of modular switching units permit flexibility in arrangement, ease of installation and expansion.

Trumbull Front-operated Interlocking (F.O.I.) Switchboard units are the culmination of 48 years experience in designing and manufacturing all kinds of electrical control equipment. They are of Class A fusible construction . . . built for low-cost operation and long life.

Equally flexible in arrangement are Trumbull Automatic Thermal Circuit Breakers (Type AT) for use in unit switchboard construction. Compact and safe, they assure continuous duty (service promptly restored after clearing harmful overloads).

Trumbull engineering "know-how" has combined the principles of unit construction and flexible arrangement to provide a coordinated switchboard assembly that can be tailored to fit your present and future electrical distribution needs.

For latest bulletins write to: THE TRUMBULL ELECTRIC MANUFACTURING CO., Plainville, Conn. Other factories and offices throughout the United States. Foreign representation.

FOR SAFETY'S SAKE—SAY "TRUMBULL"

TRUMBULL (T) ELECTRIC

Switchboards

Yes, ELGIN GIVES YOU

A 44% SOFT WATER BONUS

AN operating man said to one of our engineers: "44% more soft water is a lot of water to swallow. On what basis and by what magic do you accomplish this?"

It is not surprising that a claim as strong as ours should be challenged. But we assure you there is no "catch." When we say Elgin gives up to 44% more soft water we mean specifically that the Elgin "Double-Check" Zeolite Softener *gives up to 44% more soft water per regeneration than any other softener of equal size.*

As to how we do this, there is no mystery. We simply use more zeolite in a softener of given size and get more work out of the zeolite we use. The two accompanying diagrams tell the story. They show two zeolite softeners of equal size. One is the Elgin "Double-Check" design; the other is a softener of ordinary design. Notice that the softener of conventional design contains far less zeolite than the Elgin of the same size. This far shallower bed is necessary in the ordinary softener to prevent loss of zeolite during the regeneration process. In the Elgin Softener the "Double-Check" manifold arrangement prevents the escape of zeolite during regeneration, even when backwashed at a faster and more effective rate. That's why an Elgin Softener of given size can contain so much more zeolite.

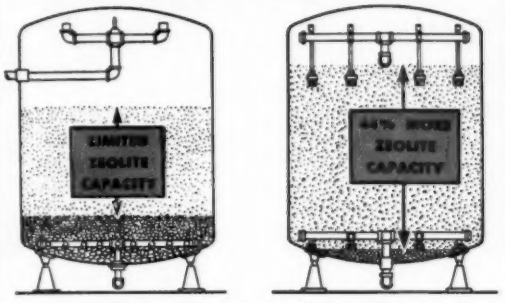
Of course more zeolite means more water softening capacity. But note, also, that by preventing escape of zeolite with the "Double-Check" manifold we also can use a higher backwash rate which means better opening up and re-grading of the zeolite bed, more thorough regeneration by the brine, maximum use of the zeolite throughout the service period. The Elgin output stays zero soft all the way!

Yes, the Elgin "Double-Check" does pay you a bonus—in soft water delivered. It costs less to buy in terms of gallons delivered, occupies less space, costs less to operate and less to maintain. Eloquent proof of the advantages of the Elgin "Double-Check" design is found in the fact that hundreds of engineers have had the Elgin "Double- heck" manifolds installed in their present softeners of other makes to obtain extra gallons of soft water the Elgin "Double-Check" Way.

Give your present softener greater capacity

You can get as much as 3 to 10 times more soft water from your present softener, regardless of make, by installing Elgin "Double-Check" manifolds and Elgin Super-Capacity Zeolite. Cost is low.

These diagrams tell the story—



ORDINARY DESIGN **ELGIN DESIGN**

SAME SIZE UNIT—SAME TYPE ZEOLITE

Ask for information on these other Elgin Water Conditioning Products

- Boiler feed water treatments
- Post treatments for softened water
- Corrosion prevention treatments for steam systems
- Corrosion prevention for hot and cold water lines
- Deconcentrator systems
- Filters and purifiers
- Iron removal equipment
- Aerators
- Chemical feeders
- Water testing equipment
- Elgin Quality Zeolites—all types

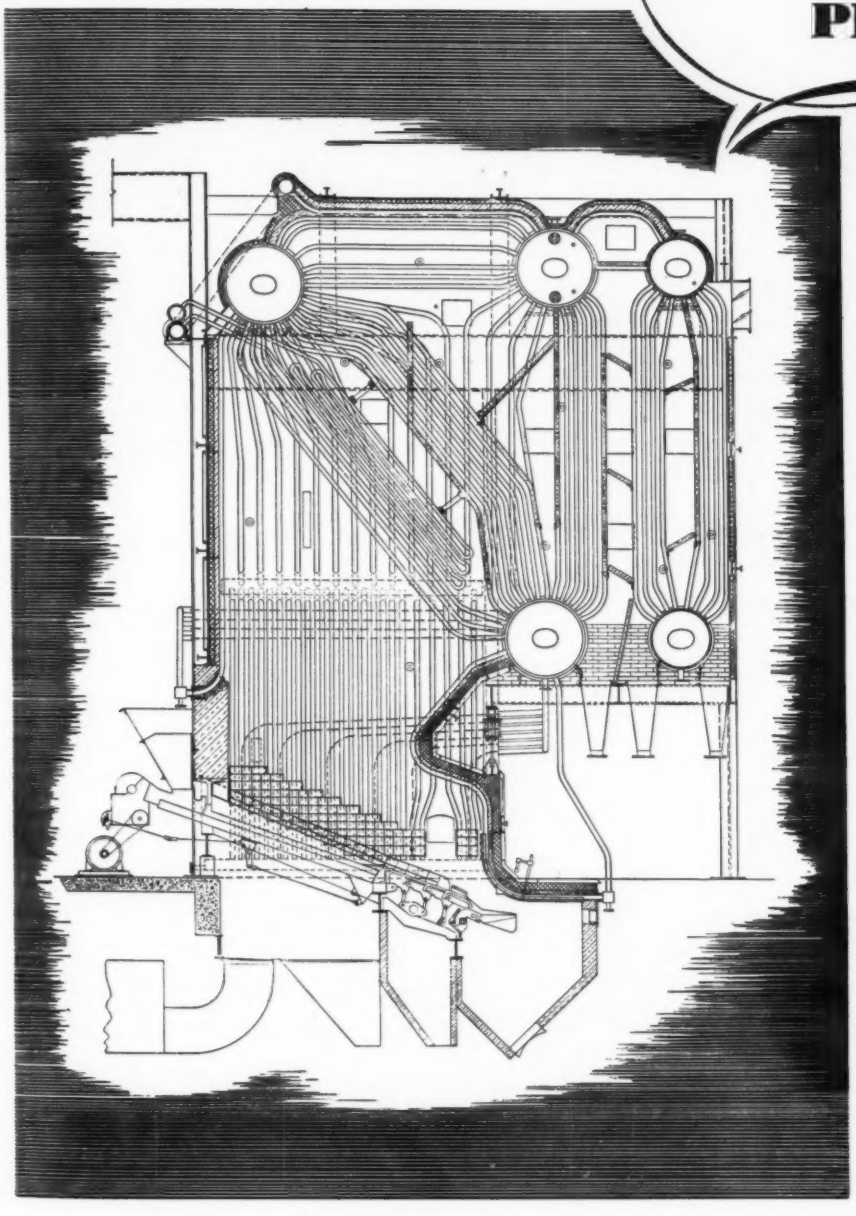
Let an Elgin Engineer Help You Plan . . .

ELGIN SOFTENER CORPORATION

189 NORTH GROVE AVENUE, ELGIN, ILLINOIS • REPRESENTATIVES IN PRINCIPAL CITIES

SOFTENERS ★ FILTERS ★ WATER TREATMENT ★ BOILER WATER CONDITIONING

70,000
POUNDS OF STEAM PER HOUR



Purchaser—

Bergstrom Paper Co.

Location—

Neenah, Wisconsin

Number of Boilers. 1
(3 Similar Erie City Steam Units Installed in 1929)

Pounds of Steam/Hr. . 70,000

Design Pressure. . . . . 325 PSI

Operating Pressure . 300 PSI

Final Steam Temperature. . . . . 575° F.

Economizer. . . . . Erie City 2 Drum Integral

Water Walls. . . . . Erie City

Sides—Cast Iron Armored at Stoker Line

Front—Bare Tube

Bridge Wall—Armored and Bare Tube with Mixing Arch

STEAM POWER PLANT EQUIPMENT

Complete Steam Generators • Type C 3-Drum Boilers • Type VL 2-Drum Boilers • The "Economic" Boiler with or without Water Walls • Welded H. R. T. Boilers • Welded Steel Heating Boilers • Coal Pulverizers • Underfeed Stokers • Welded Pressure Vessels for the Process Industries.

ERIE CITY
SINCE 1840

ERIE CITY IRON WORKS • ERIE, PA.

How 19,000 companies up take-home pay *without upping payrolls*

Can you deduct $18.75 from $60.00 and get $66.25? *Yes.* And the way you can do it is mighty important to your company—and to the nation!

You start with $60, representing someone's weekly take-home pay. You deduct $18.75 for the purchase of a U.S. Savings Bond. That leaves $41.25. But $41.25 isn't what the worker takes home. He takes home $41.25 *plus a $25 Savings Bond.* Total (assuming he holds the Bond till maturity): *$66.25.*

WHAT 19,000 COMPANIES HAVE LEARNED

In the 19,000 companies that are operating the Payroll Savings Plan for the regular purchase of Savings Bonds, employees have been more contented in their jobs—absenteeism has decreased—even accidents have been fewer!

Those are the "company" benefits the Plan provides, in addition to extra security for individual employees.

But the Plan has other, far-reaching benefits of basic importance to both your business and the national economy...

SPREADING THE NATIONAL DEBT HELPS SECURE YOUR FUTURE

The future of your business is closely dependent upon the future economy of your country. To a major extent, that future depends upon management of the public debt. Distribution of the debt as widely as possible among the people of the nation will result in the greatest good for all.

How that works is clearly and briefly described in the free brochure shown at the right. Request your copy—*today*—from your State Director of the U. S. Treasury Department's Savings Bonds Division.

ACTION BY TOP MANAGEMENT NEEDED

The benefits of regular Bond-buying are as important today as ever—but war-time emotional appeals are gone. Sponsorship of the Payroll Savings Plan by a responsible executive in your company is necessary to keep its benefits *advertised to your employees.*

Banks don't sell Savings Bonds on the "installment plan"—which is the way most workers prefer to buy them. *Such workers want and need the Payroll Savings Plan.*

Those are the reasons why it's important to make sure that the Plan is adequately maintained in your company.

The State Director will gladly give you any assistance you wish.

"The National Debt and You,"

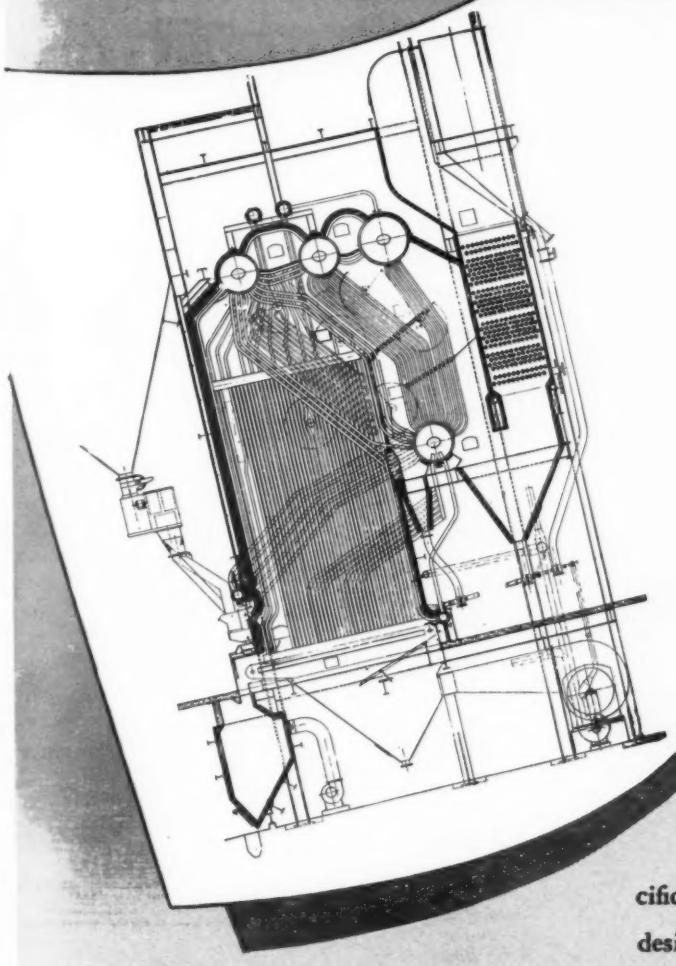
a 12-page pocket-size brochure, expresses the views of W. Randolph Burgess, Vice Chairman of the Board of the National City Bank of New York—and of Clarence Francis, Chairman of the Board, General Foods Corporation. Be sure to get your copy from the Treasury Department's State Director, Savings Bonds Division.

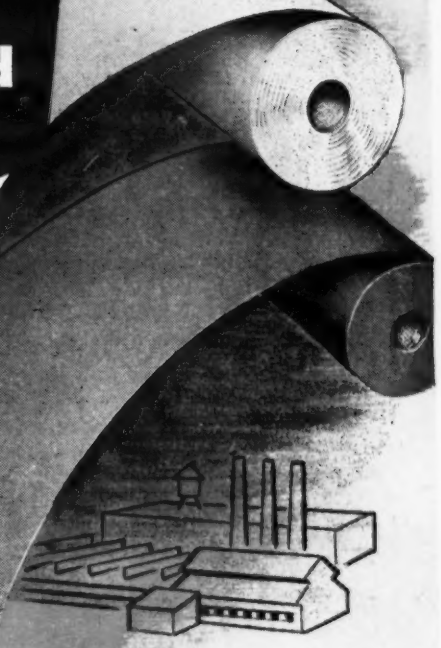
The Treasury Department acknowledges with appreciation the publication of this message by

POWER

This is an official U.S. Treasury advertisement prepared under the auspices of the Treasury Department and the Advertising Council

WICKES HELPS MAINTAIN high quality of paper board





This Wickes 4-Drum Boiler contributes its high efficiency to the manufacture of quality paper board at the River Raisin Paper Co., Monroe, Michigan. It is a unit in the power generating system designed and coordinated by Cummins & Barnard, Inc., Consulting Engineers, Ann Arbor, Michigan. Specifications include 180,000 lb. steam per hour capacity, design pressure 700 psi, and total temperature 750° F. We build and design boilers of all types up to 250,000 lb. steam per hour and 850 psi, and are always glad to cooperate with engineers in the development of equipment for specific projects.

SALES OFFICES: Atlanta • Boston • Charlotte, N. C. • Chicago • Cincinnati • Denver • Detroit • Houston • Indianapolis • Kansas City • Los Angeles • Milwaukee • New York City • Peoria, Ill. • Pittsburgh • Saginaw • San Francisco • San Jose, Calif. • Seattle • St. Louis • Tulsa, Okla. • Mexico City, Mexico.

THE WICKES BOILER CO.

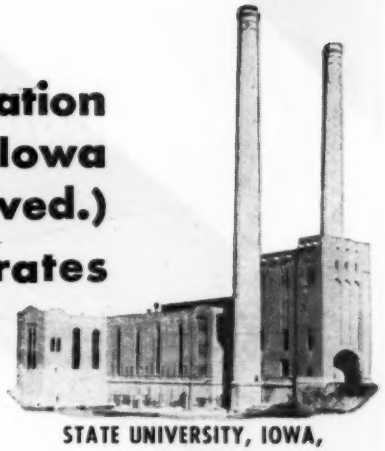
DIVISION OF THE WICKES CORPORATION • SAGINAW, MICHIGAN

RECOGNIZED QUALITY SINCE 1854

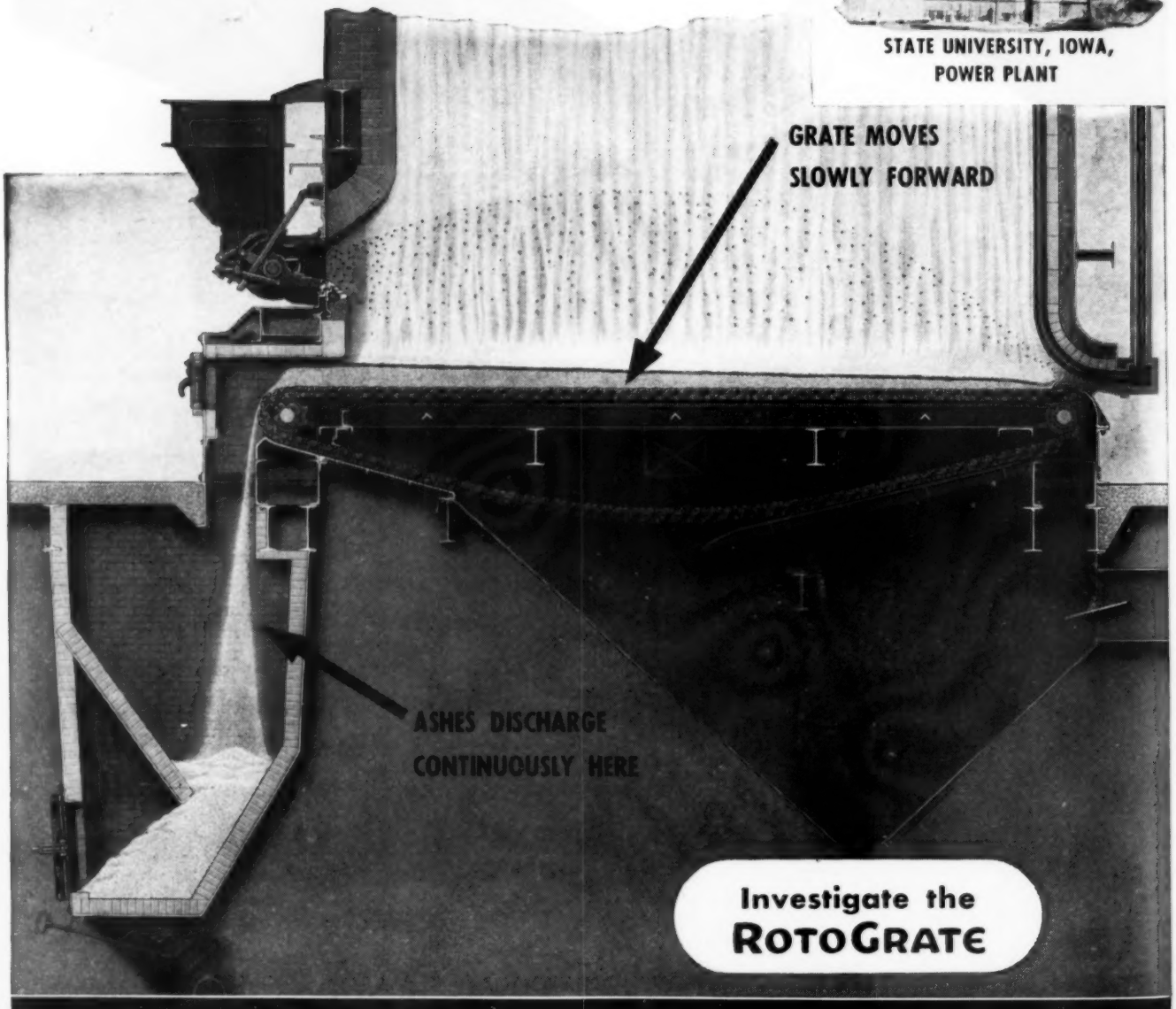
TEN YEARS' EXPERIENCE WITH DETROIT ROTOGRATE STOKER

First RotoGrates were placed in operation at the State University of Iowa at Iowa City in 1938. (Second contract now received.)

Nearly Four Hundred Detroit RotoGrates are now installed or on order.



STATE UNIVERSITY, IOWA, POWER PLANT



Investigate the ROTOGRATE

DETROIT STOKER COMPANY

Detroit has a record of success in building the original spreader stokers with forward moving, continuously cleaning grates.

Detroit RotoGrate Stokers:

- Burn wide range of fuel with low maintenance.
- High CO_2 maintained. Use preheated air.
- Operate with comparatively thin fuel bed. Low combustible loss in the ash.
- Have no difficulties with clinkers or slagging.
- Require little power for operation.
- Are installed in a variety of plants here and Abroad.
- A standard of comparison.

The RotoGrate is the original spreader stoker with FORWARD MOVING GRATES that slowly and continuously discharge the ash at the front. The RotoGrate development followed the building of hundreds of Detroit RotoStokers because:

(1) Higher burning rates are demanded for the narrower furnaces of Modern Steam Generators.

(2) Detroit RotoGrate Stokers give continuous and dependable operation for *long periods* with low quality, high ash Bituminous coal or Lignite.

RotoGrates have revolutionized the industry . . . are installed with practically all boiler types. Experience gained as stoker engineers since 1898 is available to you for Consultation without obligation. Write or wire for Bulletin No. 6030.

BREWERIES
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ELECTRICAL EQUIPMENT
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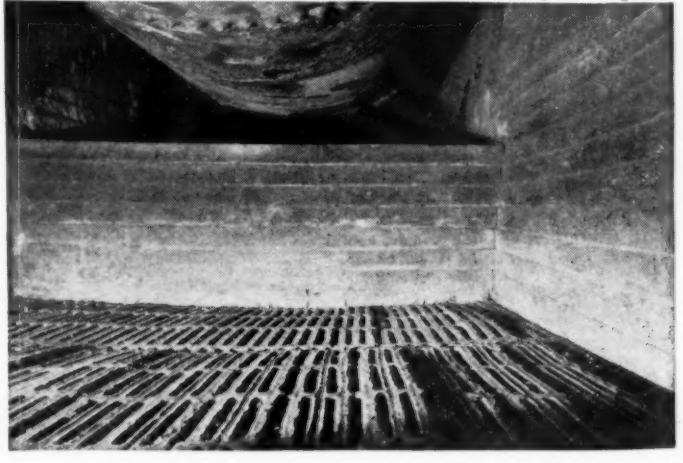
MACHINERY MANUFACTURERS
RUBBER MANUFACTURERS

DETROIT ROTOGRATE STOKER

GENERAL MOTORS BUILDING
DETROIT 2, MICHIGAN
Works at Monroe, Michigan • District Offices in Principal Cities

THE REFRACTORY *looks* AT THE JOB

BOILER furnace linings are subjected to severe wear and tear in plants operated at high capacity. Only special refractories can successfully resist high temperatures, slag penetration, abrasion and the corrosive action of coal ash slag. CRYSTOLON * Brick are considered by Norton Company to be excellent for meeting all these conditions. These heavy duty brick will give long, trouble-free service at the clinker line, in the bridge wall and front wall of coal-fired boiler furnaces.



NORTON COMPANY
WORCESTER 6, MASSACHUSETTS

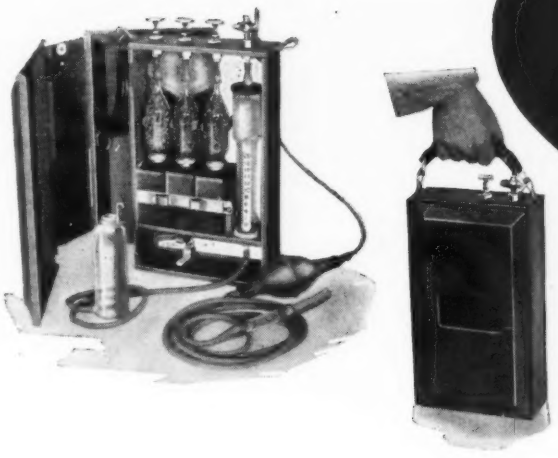
* CRYSTOLON — Trademark Reg. U. S. Pat. Off.

IN CANADA: A. P. GREEN FIRE BRICK CO., LTD.
TORONTO — HAMILTON — MONTREAL — WINNIPEG

NORTON REFRACTORIES

for ACCURATE MEASUREMENT of CO_2

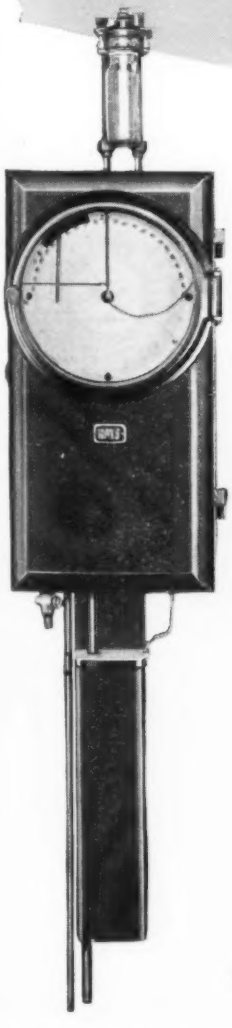
HAYS GAS ANALYZER ... Portable



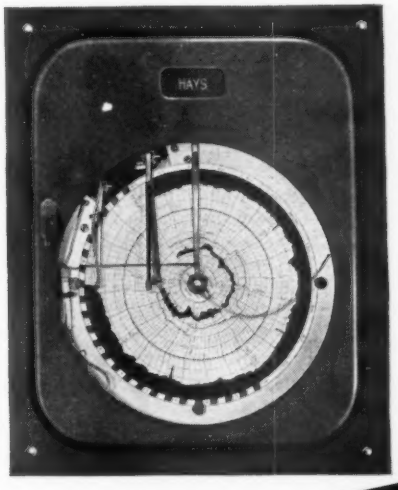
Here's the fastest known way to get "the facts" as to the CO_2 content of your flues — HAYS Portable Gas Analyzer. This simple, handy combustion tester almost always saves many times its modest cost by immediate fuel savings and by greatly increased efficiency.

HAYS CO_2 RECORDERS

... Permanently Mounted



An accurate, wholly reliable indicator of CO_2 content is the HAYS CO_2 Recorder — truly a "combustion meter" that gives an infallible recording of combustion efficiency.



It is most dependable because there are no moving parts — literally nothing to wear out; and its accuracy is generally acknowledged by all experienced combustion engineers.

Left: Integral mounted type

Right: Remote panel mounting

The HAYS CORPORATION
SINCE 1905
COMBUSTION INSTRUMENTS AND CONTROL
MICHIGAN CITY, INDIANA, U.S.A.

MORE STRENGTH.
MORE QUALITY...
MORE SERVICE...

3 REASONS WHY LADISH
Controlled Quality
FORGED STEEL Screwed and Socket Welding FITTINGS
Save Money in any Piping System . . .

L
TO MARK PROGRESS

DROP FORGED for dependability

METALLURGICALLY CONTROLLED for quality

ADEQUATELY STOCKED for prompt service

- *Complete Line of Screwed and Socket Welding Fittings*
- *Full Range of Sizes from ⅛ inch through 4 inches*
- *Pressure Ratings from 2000 through 6000 pounds*
- *Carbon, Stainless and Alloy Steels*

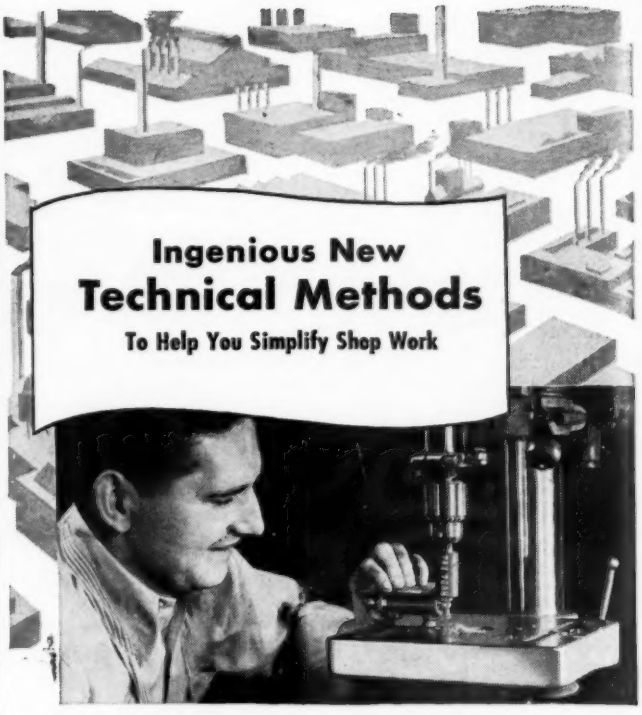
Write for Catalog, Volume 2, Today

LADISH CO.

CUDAHY, WISCONSIN (MILWAUKEE SUBURB)

District Offices: NEW YORK • BUFFALO • PITTSBURGH • CHICAGO • PHILADELPHIA
CLEVELAND • ST. LOUIS • HOUSTON • NEW ORLEANS • LOS ANGELES

STOCKED AND SOLD BY LADISH DISTRIBUTORS IN PRINCIPAL CENTERS



Ingenious New
Technical Methods
To Help You Simplify Shop Work

Metal Turning Made Easy with New Simplified Tool!

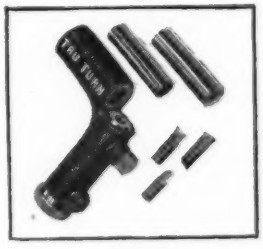
A new tool called "Tru-Turn" makes possible the conversion of drill presses, woodturning lathes, or grinder stands into tools that will turn and cut-off steel, bronze, copper and aluminum. The "Tru-Turn" tool shown above is mounted on a Buffalo Drill Press, Spindle Size.

The "Tru-Turn" tool is easy to operate and cuts and turns bar stock of steel, bronze, copper and aluminum measuring ¼", ⅜" and ½". Its built-in micrometer permits adjustments that give tool-room accuracy to 1/1000 of an inch.

Small tool shops as well as all types of repair shops and garages find the "Tru-Turn" ideal for cutting long pieces of bar stock into desired lengths. Also, home craftsmen are able to produce accurate, highly finished precision-machined parts from metal even without previous training.

Accurate, precision work is also easier to do when tension is relieved by chewing gum. The act of chewing seems to make the work go easier, faster—thus helping on-the-job efficiency. For these reasons Wrigley's Spearmint Chewing Gum is being made available more and more by plant owners everywhere.

You can get complete information from Millholland Screw Products Corp., 132 West 13th Street, Indianapolis 2, Ind.



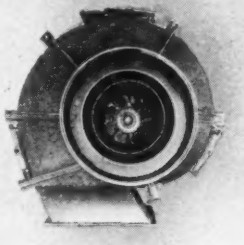
Tru-Turn Tool

AC-57

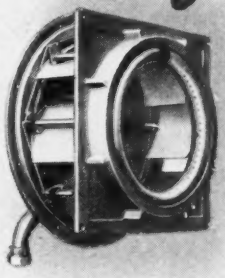
For EFFICIENT HEATING...

Depend on PEABODY

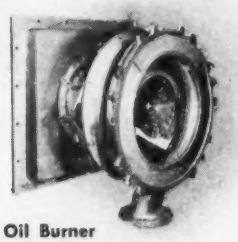
Blast Furnace Gas Burner



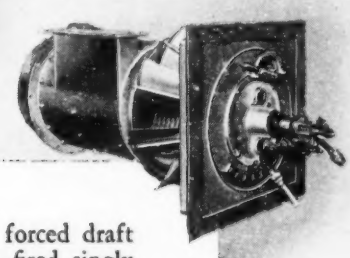
Petroleum Refinery Burner for Gas and Oil



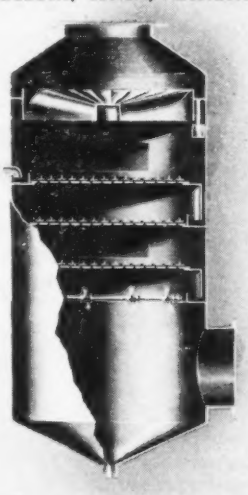
Combined Gas and Oil Burner



Combined Coal and Oil Burner



Gas Scrubbers, Coolers, Absorbers



BURNERS: Peabody builds burners for natural and forced draft — for rich and lean gases, oil and pulverized coal, fired singly or in any combination.

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FUEL OIL PUMP AND HEATER SETS: For power plants, ships and industrial installations — standard sets from 3 gpm to 50 gpm; other capacities built to specification.

Peabody's record of dependable combustion engineering is the result of 30 years research and experience. There is a Peabody representative near you who will be glad to call and discuss your combustion engineering problems without obligation.

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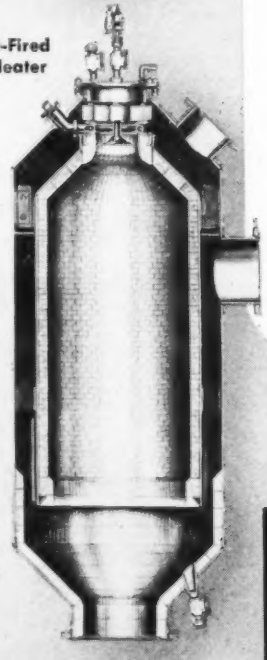
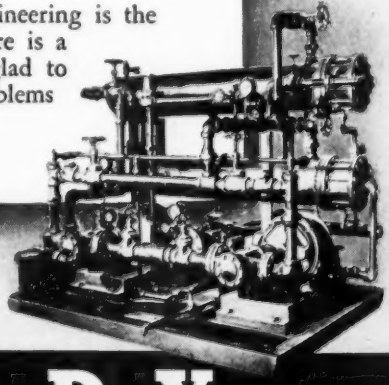


Fuel Oil Pump and Heater Set



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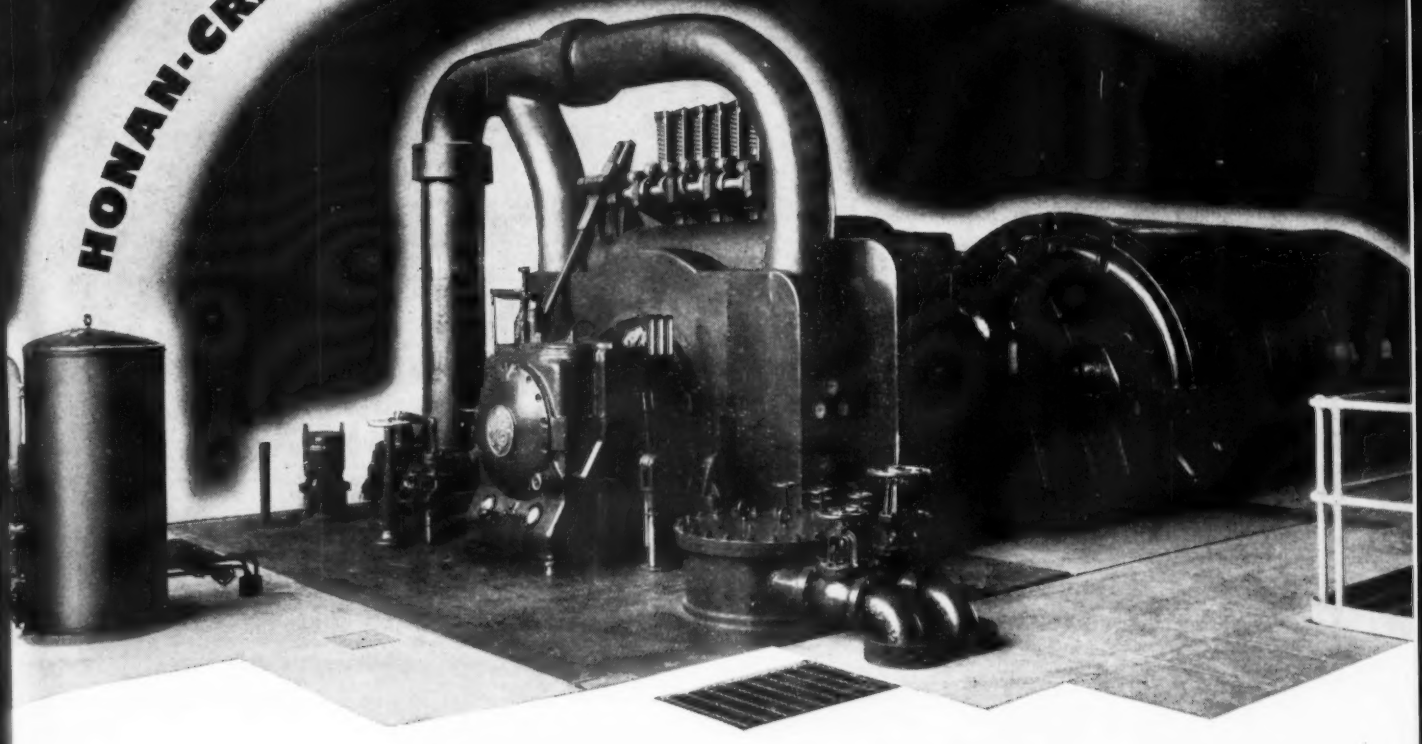

* The photo above shows a Model 30400 Honan-Crane Lube Oil Purifier direct-connected to a 25,000 KW General Electric Steam Turbine that furnishes power for the Lake Charles plant of the Cities Service Refining Corp.

...for many of the major oil companies*

There is significance in the widespread usage of Honan-Crane Oil Purifiers by petroleum refining companies—for turbine lubricating oils—for diesel lube and fuel oils—or for insulating oils.

No other industry has greater knowledge of the relation of *clean oil* to equipment maintenance. No other industry has more complete facilities for checking the actual value of oil purification—and the comparative performances of purifier and filter types.

And under these conditions, Honan-Crane Purifiers have been chosen as operating equipment by many of the major oil companies.

Honan-Crane Purifiers give you your choice of purifying media—to suit the type of oil you use—either fullers earth or cellulose fibre. Let us send you complete information on Honan-Crane Purification Equipment. Just fill out and mail the coupon.

* Shown above is a Honan-Crane equipped turbine installation. Other major oil companies using Honan-Crane Purifiers for turbines, diesel, gas and gasoline engines or other equipment are:

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Gulf Refining Company
Magnolia Pipe Line Company
Phillips Petroleum Corp.
The Pure Oil Company
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Standard Oil Company of Ohio
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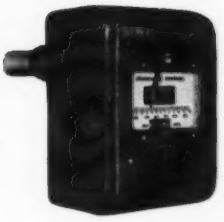

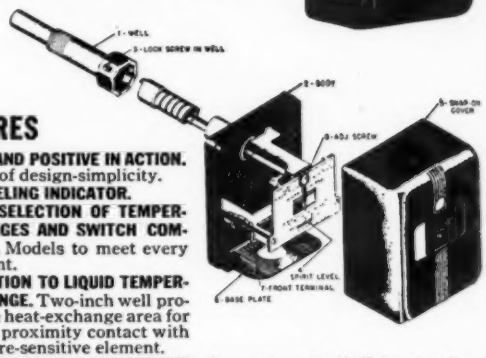

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Type "S-A-L" Steam Atomizing Oil Burner is an efficient supplementary unit in dual fuel systems (in combination with most standard pulverized coal registers). It also assures 100% reserve fuel burning equipment for alternate use during coal shortages, disablement of, or repairs to coal handling equipment or during "banked fire" periods; provides inexpensve, safe light-off of coal furnaces preparatory to igniting pulverized coal; can be dependably and safely used to maintain combustion of the pulverized coal mixture; and permits quick changeover, from one fuel to the other, without furnace shut-down.

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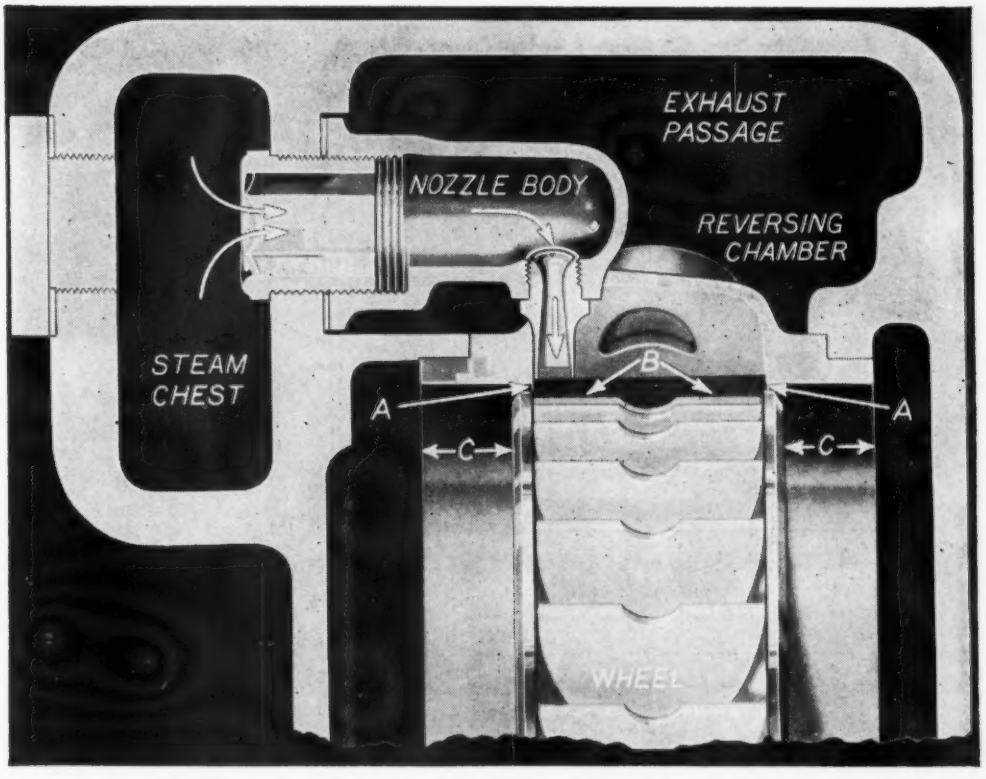

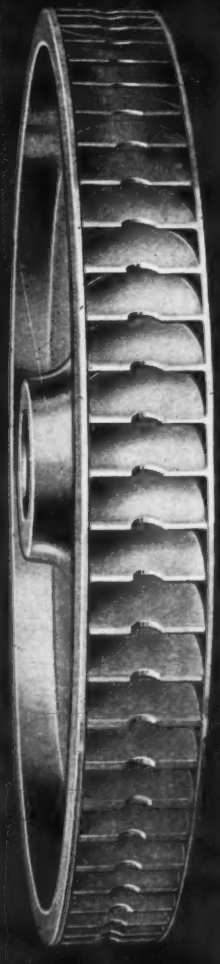

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The blades cannot foul because of the protection afforded by the rims, which are not damaged, should rubbing occur.

Note the rim clearance, AA in diagram. Also the large blade clearance, B. Side clearance, CC, is so large that end-play from external thrust cannot damage wheel.

Terry Bulletin S-116 will give you full information on the Terry Wheel Turbine. A request on your business letterhead will bring you a copy.

T-1171

THE TERRY STEAM TURBINE COMPANY
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DUDGEON TYPE 38

A complete line of expanders for tubes 2" and up in various gauges and for tube sheet thicknesses from 1/2" up. Compactly designed for use in limited space and to pass through small handholds. They provide automatic self feed with rolling and flaring in one operation. Tapered rolls insure parallel expansion for tightly rolled tubes through the full thickness of heavy drum walls or thick tube sheets. Various lengths of rolls can be furnished suitable for different thicknesses of tube sheets. Rolls are tapered on the end with well rounded bevels to prevent cutting of the tubes.

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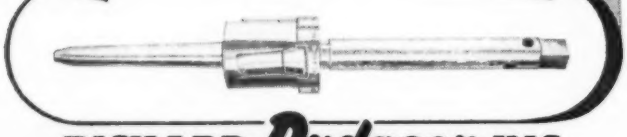
Check the reputation of DUDGEON tools on the job—ask the man who uses them! Double check too, what we mean when we say each tool is designed by and for men who know what good tools can do to cut costs and "up" job quality. Do this and you'll find that DUDGEON'S 97 years have been aggressively occupied in advancing designs, improving materials, and modernizing methods so that these expanders deliver maximum efficiency at low cost.

Complete literature on Dudgeon products — expanders, hydraulic pumps and jacks — available. Write Department J



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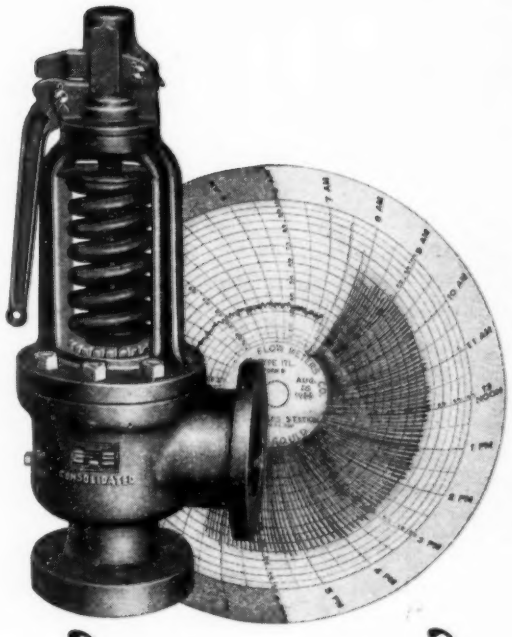

? Capacity ?

No question about capacity when your safety valves are CONSOLIDATED!

CONSOLIDATED Safety Valve capacities are rated by actual steam flow test on modern, A.S.M.E. approved, factory flow-metering equipment.

CONSOLIDATED steam testing laboratory equipment also includes the only large 1250# boiler designed for the sole purpose of testing, setting and adjusting steam safety valves under actual field conditions of high pressure and superheat.

A lifetime of experience in the solution of boiler protection problems, plus the most modern manufacturing techniques, and unmatched engineering and test facilities, are your guarantee of unmatched performance when you specify CONSOLIDATED.

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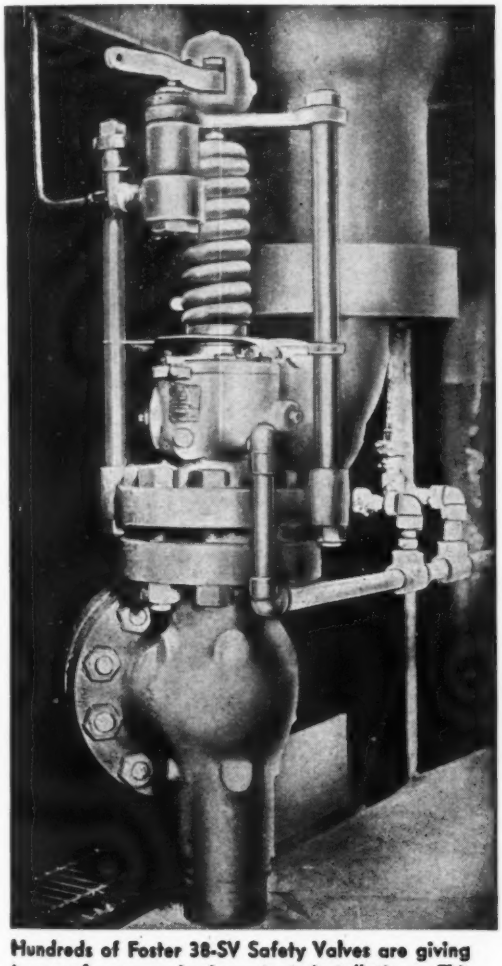
Makers of Consolidated Safety and Relief Valves, 'American' Industrial Instruments, Hancock Valves, Ashcroft Gauges

Give Your Boilers a Break!

End Safety Valve Troubles by Installing FOSTER 38-SV Safety Valves with these 5 GUARANTEED ADVANTAGES:



Hundreds of Foster 38-SV Safety Valves are giving top performance in important installations. This 2½" superheater unloading valve operates at 1450 lb., 950° total temp. Others are in service up to 2575 lb. at 1000° F.

1 Built to Stay on the Job—the Foster 38-SV is the SAFETY valve that is built to pop without causing boiler outages. On accelerated tests in an Eastern Utility, one of these valves has been popped every day for more than 6 years. It has had only routine maintenance, and yet it pops consistently at set pressure, and does not leak. In the Chief Engineer's own words—this is the equivalent of at least 40 years' normal service.

2 Accurate Popping—Once set at the desired popping point, the Foster 38-SV pops on the button for each successive pop. For instance, in another Utility installation, the 38-SV under test was set for 600 lb. and popped 50 times in quick succession. The first pop was at 600 lb. and the 50th pop was at 595 lb. In spite of the heat of this abnormal operation, the Foster 38-SV was thrown off less than 1%. After a short cooling period, it again popped at 600 lb. That's test gauge accuracy!

3 Minimum Blow-down—Foster 38-SV's are adjustable so they can be set to reseat when pressure has dropped as little as 1% below the popping point. In this same test the 38-SV, on its first pop, reseated at 594 lb. for a 6 lb. or 1% blow-down. On the 50th pop, it reseated at 589 lb. which is also 6 lb. or 1%. After each pop, it reseated positively with no chattering or leakage. Only over-pressure up the stack—no useful steam wasted.

4 High Relief Capacity—Foster 38-SV's have larger bore because they can handle larger volume of steam and still control blow-down. Depending on operating conditions, they may give more than twice the capacity of other makes, as in the case of 5 Foster 38-SV's required to replace 12 "conventional" safety valves of the same nominal size. Fewer valves to buy—fewer valves to service.

5 Low Maintenance—Hot or cold, the piston in the 38-SV fits loosely and cannot stick, and yet no steam reaches the spring. The spring stays cool enough to touch, even while the valve is popping—which means longer spring life. Disc and seat expand at the same rate during heating-cooling cycles—there is no drag to destroy seating surfaces. Simmering and chattering have been eliminated as a source of destruction. Discs will not warp or crack. When routine inspection and maintenance are indicated, complete loading assembly lifts out without disturbing the spring setting.

For full details on the design and construction features that enable this valve to outperform any other safety valve, get in touch with your Foster Representative or with us direct.

FOSTER ENGINEERING Company

PRESSURE REGULATORS...RELIEF AND BACK PRESSURE VALVES...AUTOMATIC STOP AND CHECK VALVES...ALTITUDE VALVES...DAMPER REGULATORS...FAN ENGINE REGULATORS...PUMP GOVERNORS...TEMPERATURE REGULATORS...LIQUID LEVEL CONTROLLERS...FLOAT AND LEVER BALANCED VALVES...NON-RETURN AND TRIPLE DUTY VALVES...VACUUM REGULATORS OR BREAKERS...SIGHT FLOW BOXES...STRAINERS...SAFETY VALVES...SIRENS

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FOR ASHES AND FLY-ASH

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We also specialize in improving existing conveyors through our superior fittings and frequently through rearrangement of present layouts.

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Durability combined with our exclusive discharge-efficient and self-clearing designs, preventing arching, packing and spontaneous combustion in case of coal bunkers and also obviating the necessity of hazardous trimming.

MECHANICAL SOOT BLOWERS FOR FIRE-TUBE BOILERS of ALL TYPES

Fixed nozzle centered to each tube. No cutting of tube-sheet. No moving parts in hot boiler. All tubes in boiler blown with four successive puffs of steam or air in about one minute. Perfect soot-removal from each tube END TO END.

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Hi-Pressure Gage Glasses

Round, Tubular and Flat Type

Fig. 12

RUBBER GAGE GLASS GASKETS
Series 750 . . . All Sizes

Fig. 21 Fig. 22

Other Ernst Specialties
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GAGE GLASS ILLUMINATORS
NEW PLASTIC GUARDS
SIGHT FLOW INDICATORS
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ALL IRON GAGES
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AND OTHER HELPFUL TIPS ON BOILER ROOM SAFETY

Inclined for Better Visibility
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Fig. 47

Fig. 13

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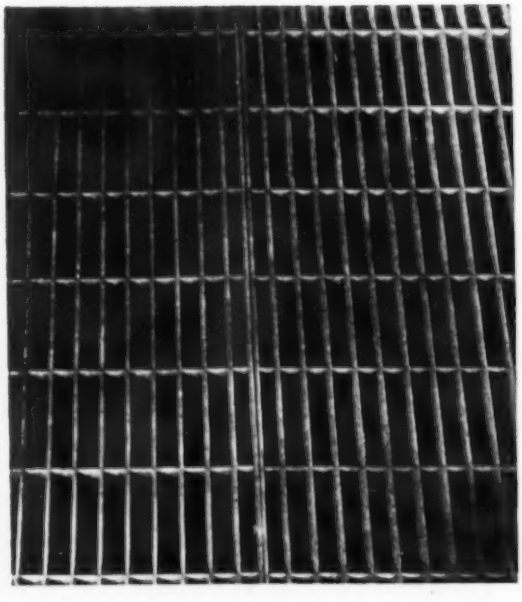
saves weight—resists corrosion



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Its light weight minimizes handling and erection costs, and maintenance painting is not required. Write for full information on this recent Hendrick development.

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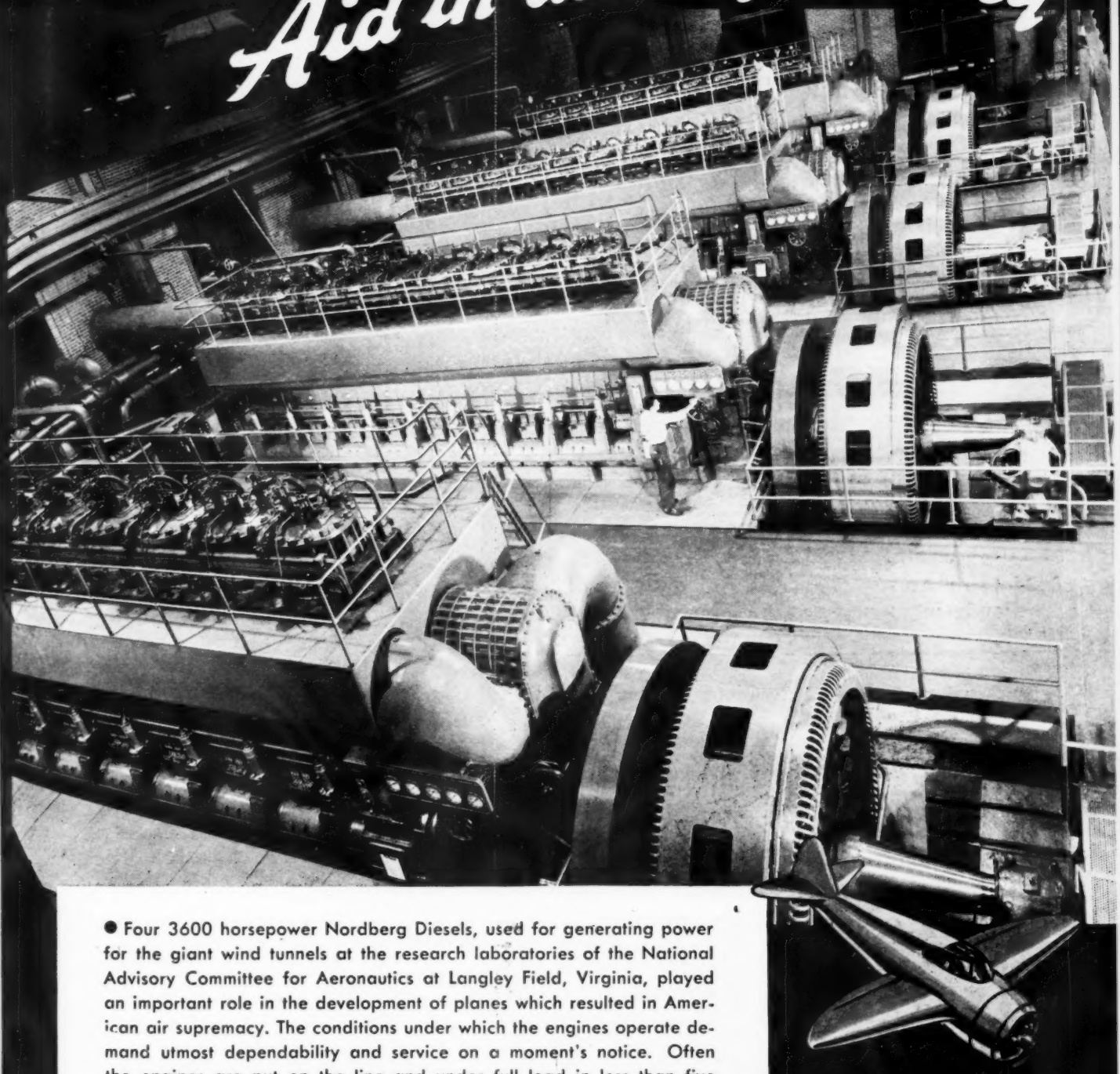
NORDBERG DIESELS

Aid in air supremacy



● Four 3600 horsepower Nordberg Diesels, used for generating power for the giant wind tunnels at the research laboratories of the National Advisory Committee for Aeronautics at Langley Field, Virginia, played an important role in the development of planes which resulted in American air supremacy. The conditions under which the engines operate demand utmost dependability and service on a moment's notice. Often the engines are put on the line and under full load in less than five minutes. As many as 26 starts have been recorded in an eight hour shift. Even with these unstable operating conditions — short runs and frequent starts — the engines averaged better than 12½ KW hours per gallon of fuel over a 7 year period. This is just one more example of the kind of service given by Nordberg Diesels and which is being proved in many of the larger Diesel engined power plants of the country.

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Now "GENERAL" Offers

a complete Line of

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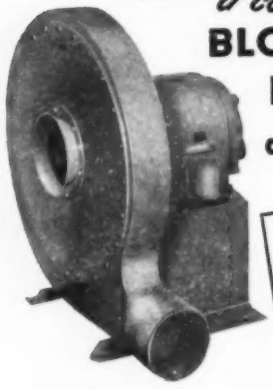

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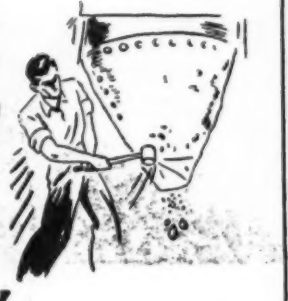
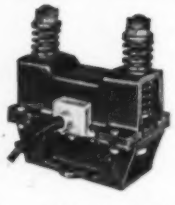


SYNTRON

"Pulsating Magnet"

ELECTRIC VIBRATORS



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Eliminate Pounding and Sledging

Controlled, pulsating vibrations penetrate the mass—activate each particle and break down arching and plugging.

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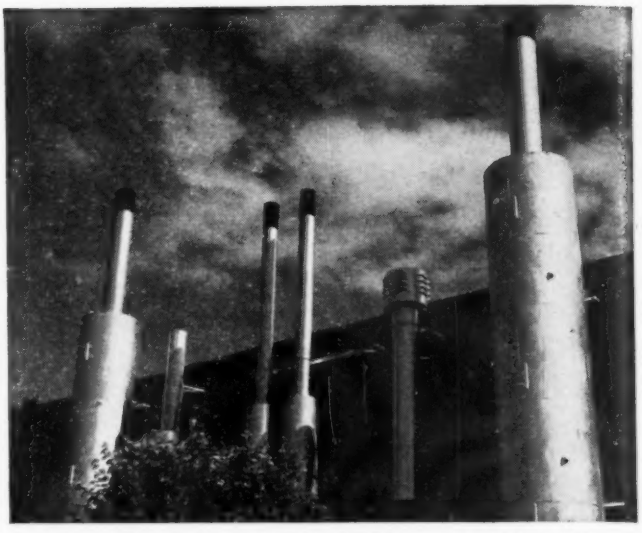

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EXHAUST AND INTAKE SILENCERS

SPARK ARRESTOR SILENCERS

STEAM BLOW-OFF SILENCERS

Over the years Maxim has had the practical experience and research facilities to develop and build the finest silencing equipment available. Throughout industry Maxim Silencers have become a standard for many silencing jobs: on internal combustion engine exhaust and intake — compressor intake — vacuum pump discharge and steam blow-off. Maxim Heat Recovery Silencers recover waste exhaust heat to produce steam or hot water and afford the opportunity for a highly efficient hook-up. Maxim Spark Arrestor Silencers provide 100% positive spark arresting and are invaluable where a fire or dirt nuisance hazard exists.

Maxim offers a wide choice of standard silencers to fit the requirements of nearly any installation. The Maxim engineering department is always available to you for consultation and consideration of special silencing problems.

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THE MAXIM SILENCER COMPANY

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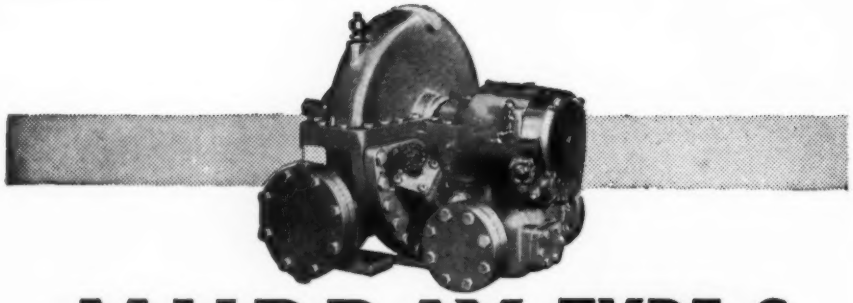
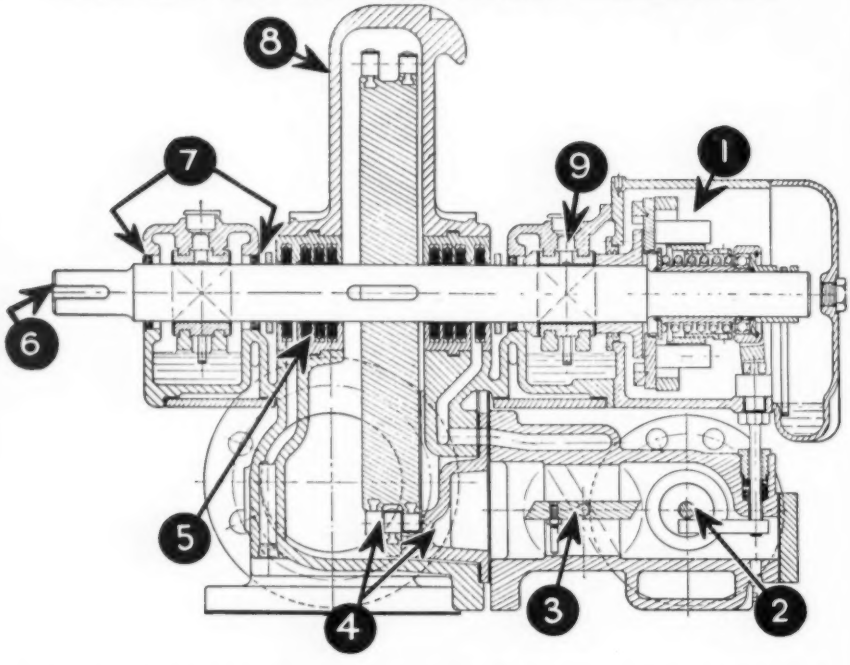


MURRAY *TYPE-S*

SINGLE STAGE TURBINES FOR MECHANICAL DRIVE



1. Mechanical constant speed governor completely enclosed and fully lubricated. Heavy cast housing, removable for inspection. Provision for tachometer reading, by removing end plug.
2. Double seated balanced stainless steel governor valve, with stainless steel renewable seats. Corrosion resisting steam strainer ahead of control valves.
3. Separate emergency overspeed butterfly trip valve actuated by unbalanced weight type emergency overspeed governor.
4. Stainless steel blading and shroud band. Nozzles drilled and reamed in replaceable nozzle ring.
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6. Tapped hole in shaft end facilitates drawing on coupling.
7. Bearing seals effectively retain oil and exclude dirt and moisture.
8. Casing split at centerline allowing inspection without disturbing alignment or steam connections.
9. Sleeve type babbitt lined bearings with split oil rings, easily removable. Babbitt thrust faces against collars. Inspection covers and flush level glasses included. Water cooling always furnished.

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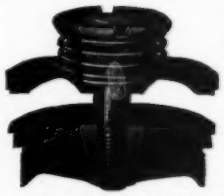

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Diesel Engines

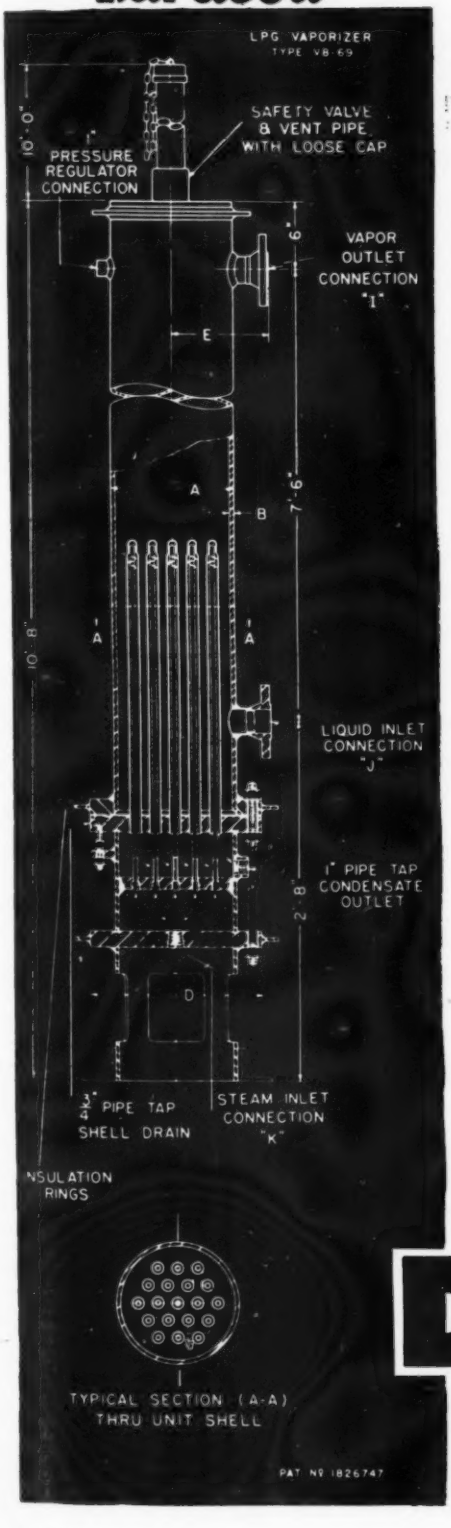
A SPECIAL SECTION

In its April Issue, POWER will commemorate the 50th Anniversary of the American diesel engine with a comprehensive survey of modern engines. Watch For It!

"HOT PLATE" LPG STEAM VAPORIZER

for Medium and High Capacity L. P. G. SYSTEMS

Paracoil


LPG VAPORIZER
TYPE VB-69
SAFETY VALVE & VENT PIPE WITH LOOSE CAP
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When plant site weather conditions are sufficiently severe as to indicate the use of a Vaporizer with your L.P.G. system, the Paracoil "Hot-Plate" Steam Vaporizer offers operating advantages possessed by no other unit.

FEATURES

- **PATENTED "HOT-PLATE" NON-FREEZING CONDENSATE DRAINAGE SYSTEM.**
- **Installed Above Ground—Entirely Outside the Storage Tank. Can be used with Any Type of L.P. Gas.**
- **High Output Capacity—Up to 1000 Gallons Per Hour Per Unit.**
- **Fully Automatic in Operation.**
- **No Moving Parts—Nothing to Get Out of Order.**
- **Fitted with Approved Type Relief Valve.**
- **No Vaporizer Flames Used—Operates on Low Pressure or Exhaust Steam.**
- **Easy Access to Heating Surface for Inspection.**

SIZE NO.	CAPACITY GALS./HR.	DATA A	B	D	E	K	I	J	SAFETY VALVE SIZE	WEIGHT LBS.
H-24S	125	10¾	.365	15⅛	9½	1	2	2	1½	770
K-24S	200	12¾	.375	17¼	10½	1	2	2	1½	1100
L-24S	300	14	.375	18½	11¼	1	2	2	1½	1260
N-24S	500	16	.375	20½	12½	1½	2	2	1½	1590
T-24S	1000	22	.375	26½	16	2	2	2	2½	2690

All Dimensions in Inches — Dwg. 1-14568-B

SPECIFICATIONS

MATERIAL

Outer Shell	—Seamless Steel Pipe
Outer Vaporizing Tubes	—⅞" OD 16 BWG Seamless Steel
Inner Steam Conveyor Tubes	—½" OD x 20 BWG Seamless Copper
Tube Sheets and Flanges	—Rolled Steel Plate
Steam and Condensate Channels	—Welded Steel
Supporting Base	—Welded Steel

DESIGN

A.S.M.E. Code, Par. U-69
N.B.F.U. Pamphlet No. 58, Spec. B.10.i

Working Pressure:	Shell	250 PSIG	(Liquid Vapor Side)
	Tubes	200 PSIG	(Steam Side)
Test Pressure:	Shell	500 PSIG	Hydrostatic
	Tubes	400 PSIG	Hydrostatic

Liquid Inlet Connection — 300 Lb. Design
Vapor Outlet Connection — 300 Lb. Design

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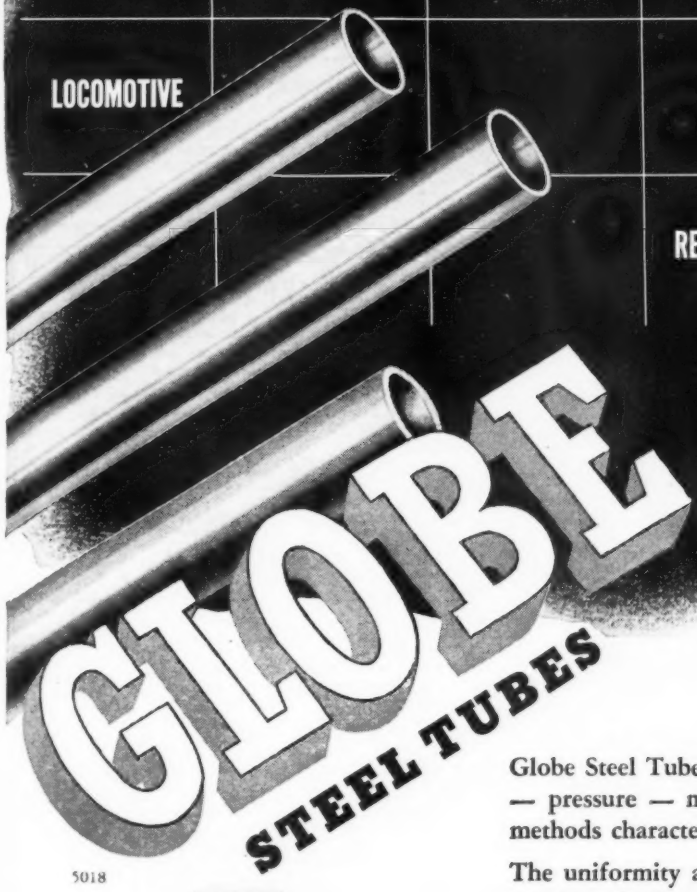
			RECTANGULAR	ROUND	SQUARE



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GRADUATE MECHANICAL Engineer wanted: Test and efficiency engineer with educational background such that he can be trained to make tests and analyze performance data in a modern steam power plant. Permanent position with a well known electric utility in Northwestern Ohio. Good opportunity for advancement. Write full particulars about age, experience, education, salary requirements to P-3449, Power.

WANTED—CAPABLE Advertising Manager, Mechanical Engineering experience, smart, alert. Must have 4 years' experience industrial advertising or agency and in power plant specialties. Private company Middlewest. Splendid opportunity for right man. P-3917, Power.

LARGE INDUSTRIAL foundry has opening for practical engineer with electrical-mechanical background, past supervisory training and experience in the servicing and operation of DC and AC cranes. Good working conditions with progressive organization. Good salary to one qualified Man selected will be given full charge of crew and equipment and be responsible for efficient operation of same. Age range—28-40. Location, Michigan. P-3850, Power.

WORKS ENGINEER wanted by old established Eastern Pennsylvania Manufacturer. Must be graduate M.E., 35-40 years of age, with at least 10 years experience in plant engineering. Knowledge of foundry practice desirable. Write P-3732, Power, giving personal history, qualifications, experience and salary expected. P-3732, Power.

ELECTRICAL CONSTRUCTION Engineer with utility power plant experience. Location Pittsburgh district. Write giving details of experience, age and salary expected. Replies to P-3711, Power.

SELLING OPPORTUNITIES OFFERED

PROMINENT CHIMNEY concern desires agent Cleveland, Ohio, territory contacting industrial plants and engineers; write giving full particulars. RW-3567, Power.

SALES ENGINEER power chemicals division of large chemical manufacturing organization has opening for representatives in east, south and mid-west for sale of industrial water treatments—prefer men with experience or suitable chemical background. Salary, expenses and bonus arrangement—send full particulars for interview—all replies confidential. E. F. Drew & Co., Inc., 15 E. 26th Street, New York 10, N. Y.

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SALARIED POSITIONS $3,500 and upward. If you are considering a new connection communicate with the undersigned. We offer the original personal employment service (38 years recognized standing and reputation). The procedure, of highest ethical standards, is individualized to your personal requirements and develops overtures without initiative on your part. Your identity covered and present position protected. Particulars on request. R. W. Bixby, Inc., 270 Dun Bldg., Buffalo 2, N. Y.

SALARIED PERSONNEL $3,000-$25,000. This confidential service, established 1927, is geared to needs of high grade men who seek a change of connection under conditions assuring, if employed, full protection to present position. Send name and address only for details. Personal consultation invited. Jira Thayer Jennings, Dept. G, 241 Orange St., New Haven, Conn.

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GRADUATE ELECTRICAL and Mechanical Engineer. Twenty years of experience in installation and management of diesel and hydroelectric power plants, substations, public utility and industrial maintenance, serving as power plant superintendent in border city of Mexico desires change. Would accept representative or executive position in any Spanish or English speaking country. Will furnish best references and resume of experience to interested Corporations. PW-3190, Power.

MECHANICAL MAINTENANCE supervisor, 42 years old, 23 years in steam electric power plants, 10 years in supervision utility co. plants. Am not a graduate engineer but have worked consistently learning the technical aspects of my job. Am seeking position in mechanical maintenance or as manufacturers service engineer. Any location considered. Let us discuss your need and my qualifications. PW-3580, Power.

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1—125 KW Crocker Wheeler 125 V. 1200 RPM, 2300 V., Squirrel Cage.

1—100 KW Elec. Mach. 125 V., 1200 RPM 4150 volt, synchronous.

1—100 KW General Electric, 230 v., 900 RPM, TS 4150 v. syn.

1—50 KW Ridgeway 1200 RPM. 550 Volt, Motor Sq. Cage, 220 volt.

1—5 KW General Electric, AC Gen. 1800 RPM. 120 volt, single phase, DC Motor, 230 volt.

4—100 KW General Electric, 60 volt, 1200 RPM, 125 HP Squirrel cage 220/440 volt.

ENGINE GENERATOR SETS

1—150 KVA General Electric, Ames Uniflow 220 volt, 3 phase, non-condensing.

2—13 x 15 Uniflow Engines 150/300 RPM. for Ice Compressors.

1—200/273 volt Gasoline Van Bierck 8 cyl. 1500 RPM.

TURBO GENERATOR SETS

1—300 KW General Electric ATB 240 Volt, 3 phase, condensing.

1—30 KW Allis Chalmers 3600 RPM, 125 volt, Terry Non-condensing.

PLATING SETS

1½ KW G.E., 1800 RPM. 5/6 volts, squirrel cage motor.

12 KW Hanson Van Winkle 24 volt with exciter, 1200 R.P.M. with squirrel cage motor.

TURBINE BLOWERS

1—Spencer Turbine Blower, 100 cubic feet, 30 oz. pressure with a 15 H.P., 3600 RPM, General Electric, Type FT, 200 volt motor.

1—Bellmore, 550 cubic feet, 7 inch vacuum, with a 20 H.P., 3600 RPM. General Electric, Type K, 220 volt, 3 phase motor.

TRANSFORMERS

1—100 KVA Westinghouse, 13200 volt, 250 volt, single phase.

46—50 KVA Westinghouse, 13,800 primary, 120 volt secondary.

35—50 KVA G.E. 13,800 primary, 120 volt secondary.

5—50 KVA Westinghouse, 13,800 primary, 125 volt secondary.

5—50 Westinghouse 12,800 primary, 240/120 secondary.

10—27½ KVA General Electric brand new Air Cooled 440/220 220/110 single phase.

3—10 KVA Westinghouse Air Cooled, 450 volt, primary, 117 Volt secondary, single phase.

A. C. GENERATORS

250 KVA Westinghouse, Syn. Condenser, 720 RPM. 2300 v.

320 KVA Allis Chalmers, 450 RPM., 480 v.

240 KW General Electric .8 PF, 600 RPM. ATB, 600 volts, DC exciter.

200 KVA Allis Chalmers, 3600 RPM. 240 volt, 2 phase, DC exciter.

200 KVA Westinghouse, 600 RPM. 240 volt, 3 phase, DC exciter.

200 KVA Allis Chalmers, 900 RPM. 240 volt, 3 phase, DC exciter.

180 KW Westinghouse, 514 RPM. .8 PF. 550 volt, 3 phase.

2—167 KVA General Electric, 1200 RPM. .6 PF. 450 volt, 3 phase.

165 KW Electric Machinery, 514 RPM. 240 volt, 3 phase.

100 KW General Electric, ATB, 600 RPM. 240 volt, 3 phase, DC exciter.

62½ KW Allis Chalmers, 3600 RPM. 220 volt, 3 phase, DC exciter.

35 KW Columbia Elect. .8 PF. 1200 RPM. 240 volt, 2 phase, DC exciter.

31.3 KVA American Customs, .8 PF. 1200 RPM. 120/208 volt, 3 phase, DC exciter.

12.5 KVA Westinghouse, .8 PF. 1200 RPM. 240 volt, 3 phase, DC exciter.

SYNCHRONOUS MOTORS

150 HP General Electric, T.S. 900 RPM. 4160 volt, 3 phase, DC exciter.

75 HP. 1200 RPM. General Electric, 440 volt, 3 ph. DC exciter.

70 HP. Electric Machinery, 180 RPM. 2200 volt, 3 phase.

40 HP. Westinghouse, 1800 RPM. 220 volt, 3 phase, DC exciter.

35 HP. General Electric, 1200 RPM. 2200 volt, 3 phase, DC exciter.

20 HP. Westinghouse, 1800 RPM. .8 PF. 220 volt, 3 phase.

MOTORS—3 ph. 60 cycle
SQUIRREL CAGE

1—750 HP General Electric, 750 RPM. 6600 volt, 3 phase, 25 cycle.

1—150 HP General Electric 1K, 450 RPM. 440 volt.

1—125 HP U. S. 1200 RPM. vertical hollow shaft, 220 volt, 3 phase, 60 cycle.

1—450 HP Ridgeway 900 RPM. 2200 volt, 3 phase.

1—75 HP Westinghouse, 1800 RPM. 2200 volt.

1—75 HP General Electric, Type KT, 1200 RPM. 440 volt.

1—60 HP Westinghouse, 900 RPM. Type CS, 220 volt.

3—40 HP General Electric, Type KT, 900 RPM. 220 volt, 3 phase.

1—35 HP General Electric, Type 1, 600 RPM. 350 volt, 3 phase.

2—10 HP Westinghouse gear 440 RPM. output 440 volt, 3 phase.

MOTORS—3 ph. 60 cycle
SLIP RING

1—200 HP General Electric, 720 RPM., M.T. 2200 V.

1—100 H.P. Westinghouse, 720 RPM. CW, 440 volt, 60 cycle.

1—100 HP General Electric, 720 RPM, IM, 440 volt, 25 cycle.

1—60 HP, General Electric, 600 RPM. MT, 220 volt.

1—50 HP, General Electric, Type MT, 600 RPM. 220 volt.

1—50 HP F & B, 1800 RPM. BV, 220 volt.

1—50 HP General Electric, 900 RPM. IM, 440 volt.

1—40 HP Cont. 1150 RPM. SA55, 220 volt.

1—40 HP General Electric, 1130 RPM. MT, 220 volt.

1—40 HP General Electric, 900 RPM. MT, 220 volt.

1—40 HP General Electric, 900 RPM. MTI, 2000 volt.

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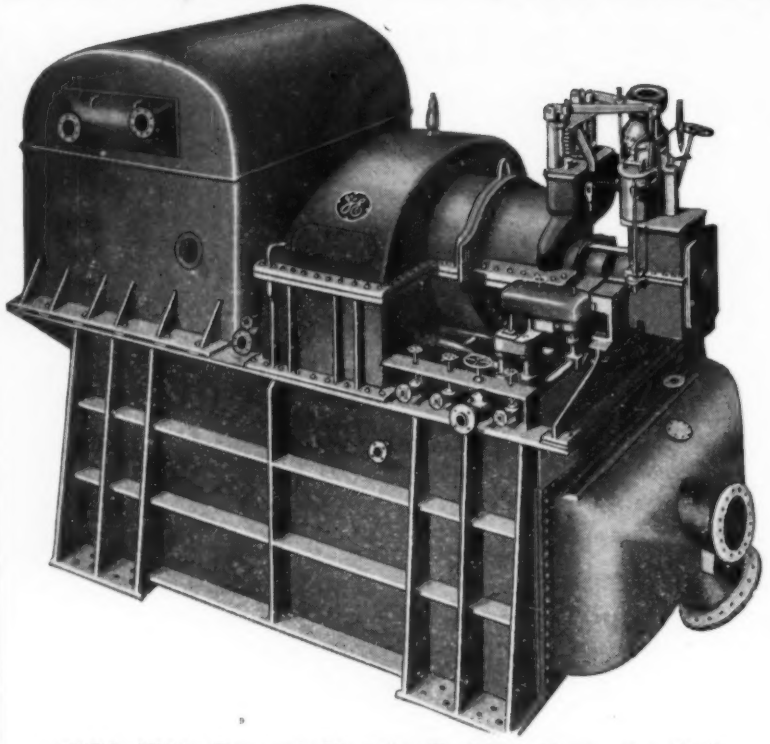


2250 KVA General Electric Turbine Generator Unit
New 1943—Excellent Condition

PACKAGE TYPE TURBINE GENERATOR UNITS AND BOILERS

3—1800 KW 80% P. F. 2250 KVA General Electric alternating current generators, type ATB, 3 phase, 60 cycle, 480/600/2300/4150 volts, 3600 RPM, direct connected to General Electric condensing turbines, 10 stage, 250/400# steam pressure, 0-275 deg. superheat, 725 deg. total temperature, 3600 RPM. Equipped with air coolers, surface condensers and auxiliaries.

4—60,000# steam per hour Foster Wheeler boilers, 435# pressure, 750 deg. TT, equipped with waterwalls, superheaters, economizers, soot blowers, and Todd oil burners.

CONDENSING TURBO UNITS

3 phase 60 cycle

3125 KVA Wstgh. 600 volts, 250# steam
2250 KVA (3) G. E. 480 v., 250/400# steam
1875 KVA (2) G. E. 2300/600 volts, 250# steam
1875 KVA Allis 480 volts, 175# steam
1250 KVA (2) G. E. 2400/480 v., 200#
937 KVA Allis 480 volts, 175# steam
375 KVA (4) G. E. 480 v., 400# steam

NONCONDENSING TURBO UNITS

3 phase 60 cycle

2500 KVA G. E. 480 volts, 150# steam, 15# exhaust
1250 KVA Wstgh. 2400 volts, 300# steam, 10# exhaust
1250 KVA (2) DeLaval 4150 volts, 250# steam, 70# exhaust
625 KVA G. E. 2300 volts, 200# steam, 7# exhaust

SPECIAL

6—250 KVA G. E. noncondensing turbine generator units, 3 phase, 60 cycle, 480/240 volts; 400# steam pressure, 0-10# back pressure.

EXTRACTION TURBO UNITS

3 phase 60 cycle

3750 KVA Wstgh. 2400 volts, 150# steam, 10# extraction
1563 KVA Wstgh. 2400 volts, 175# steam, 15# extraction
1250 KVA Allis 480 volts, 300# steam, 35# extraction
940 KVA Westgh. 600 volts, 150# steam, 20# extraction
875 KVA Moore 2300 volts, 300# steam, 100# extraction

UNIFLOW UNITS

3 phase 60 cycle

625 KVA Skinner, 2300 volts, 140# steam, 5# exhaust
375 KVA Skinner, 2300 volts, 125# steam, 5# exhaust
312 KVA Skinner, 480 volts, 165# steam, 5# exhaust
250 KVA Skinner, 480 volts, 165# steam, 5# exhaust
208 KVA Skinner, 240 volts, 125# steam, 5# exhaust

SYNCHRONOUS MOTORS

6—3500 HP G. E. synchronous motors, 3 phase, 60 cycle, 4000/2300/550/440 volts, 257 RPM.

DIESEL UNITS

3 phase 60 cycle

1250 KVA (2) General Motors, 2300 volts
250 KVA (3) McIntosh-Seymour, 2300 volts
187 KVA (3) Fairbanks Morse, 2400 volts

GENERATORS

3 phase 60 cycle

2500 KVA (4) G. E. 2300/480 volts, 257 RPM
1150 KVA Wstgh. 600 volts, 400 RPM
750 KVA (2) G. E. 600 volts, 300 RPM

MOTOR GENERATOR SETS

3 phase 60 cycle

200 KW G. E. 250 v. D. C., 440 v. A. C.
200 KW C. W. 125 v. D. C., 2300 v. A. C.

ROTARY CONVERTERS

3 phase 60 cycle

3500 KW G. E. 225/285 v D. C., 13800 v. A. C.
1500 KW (2) Wstgh. 270 v. D. C., 13800 v. A. C.

TRANSFORMERS

18—25 KVA General Electric transformers, single phase, 60 cycle, 460-120 volts.

INTERNATIONAL POWER MACHINERY CO.

UNION COMMERCE BLDG. PHONE LONG DISTANCE 350 CLEVELAND 14, OHIO

RE-NU-BILT BELYEA MOTORS

Behind this name

RE·NU·BILT

ELECTRICAL EQUIPMENT REBUILT BY SPECIALISTS

BELYEA

THE TRADE MARK *that means* **"SUCCESSFUL OPERATION GUARANTEED"**

SPECIAL General Electric Spirakore transformers 167 KVA, 2400/4160Y volt primary, 120/240 volt secondary, single phase 60 cycle, OISC. Can also furnish 240/480 volt secondary. Newly wound. Can also furnish with 600 v. sec.

THE NAME *that says:* **"OUR REPUTATION IS YOUR PROTECTION**

MOTOR GENERATOR SETS

3 ph. 60 cycle

Qu.	KW	Make	Speed	D.C. Volts	A.C. Volts
1	1500	G.E.	600	600	2300/4150
1	100	West.	514	250	4150
2	1000	Whse.	900	600	6600/12500
1	1000	Al. Ch.	720	450	2300
2	750	Whse.	900	275	6600
2	500	G.E.	720	600	2300/4150
1	500	G.E.	720	600	6600/13200
1	500	G.E. (3 u)	1200	250	440
1	500	G.E.	720	600	4400
1	500	G.E.	720	125	6600/13200
1	400	G.E. (3 u)	720	125/250	2300
1	400	Whse.	1200	250	440/2300
1	300	G.E.	720	550	2300/4000
1	250	G.E.	720	275	2300/4000
1	250	G.E.	1200	250	440
1	200	G.E.	720	125	440
1	100	G.E.	1165	250	440
1	100	G.E.	1170	125	220
1	160	Delco	1200	125/250	440
4	90	G.E.	1180	60	220/440
2	75	Ct. Wh.	1160	250	220/440
1	75	G.E.	1180	125	2300/4000
1	60	Cr. Wh.	1750	250	220/440
1	50	G.E.	1145	125	220
2	50	G.E.	1200	250	2200
1	48	G.E. (3 u)	1750	60	440

FREQUENCY CHANGER SETS

1—1000 KW—GE—2 Unit—3 Brg. Consisting of—1400 HP—4400 V, 3 ph. 25 Cy. Motor and 1000 KW—2300 V. —8 ph. 58.3 cycle gen. with exciter (Gen. can be reconnected for 800 KW 3 ph.)

1—320 KW—GE—2 Unit—3 Brg. consisting of 600 HP—440 V, 3 ph. 60 cy., .8 pf. Syn. Motor and 400 KVA .8 pf. type AT—3 ph. 120 cy. 720 volt AC generator with direct connected exciter.

ROTARY CONVERTERS

60 Cycle

KW	Make	Speed	D.C. Volts	A.C. Volts
1—1500	Whse.	720	600	2300
1—1000	G.E.	900	600	11000
1—1000	Whse.	900	600	11000
1— 750	Whse.	900	600	13200
1— 750	Whse.	720	250	6600
1— 500	G.E.	900	250	2300

D. C. MOTORS

HP	Make	Type	Volts	Speed
1—1200	Whse.		600	425
1—800/1000	Whse.		450	600/720
1—800	G.E.	MPC	600	600
1—765	G.E.	MPC	500	1045/1350
1—700	G.E.	MCF	600	150/525
1—650	G.E.	MPC	250	115/145
1—375	G.E.	MPC	230	450/900
2—350	G.E.	MPC	250	450
1—335	Whse.	MQ	250	300/900
1—300	G.E.	DMC	230	400/600
1—300	G.E.	MPC	230	275/550
1—250	G.E.	MPC	230	400/500
1—230	Al. Ch.		230	700
1—150	G.E.	MPC	230	250/450
8—150	Cr. Wh.	83H-TEFC	230	890
1—150	Cr. Wh.	CCM	230	300/1050
1—150	Cr. Wh.	CMC-65H	230	1150
2—125	G.E.	CO-1832	230	625
1—125	G.E.	CD-125	230	1150
1—115	Cr. Wh.	JH1.	230	1200
4—101	Whse.	SK	230	485/950
8— 75	Cr. Wh.	53-H	230	860
1— 75	Cr. Wh.	CMC	230	1150/1760
1— 60	El. Dy.	25-S	230	525/1050
2— 60	Whse.	Hoist.	230	415
1— 60	Whse.	SK	230	500/1000
1— 60	Whse.	SK-131	230	500/1500
2— 50	G.E.	RCP-31B	230	1700
1— 50	G.E.	RC-34	230	1050
1— 50	G.E.	RF-16	230	500/1500
1— 50	Whse.	SK-131	230	500/1500
4— 50	Whse.	Hoist.	230	400
1— 50	Whse.	SK-153	230	690/1035
1— 50	G.E.	CD-123	230	675/1035
1— 50	Whse.	SK-170	230	350/1050
1— 50	Cr. Wh.	CMC-8014	230	380/750
1— 50	Rel.	461-T	230	250/1000
7— 40	Rel.	385-T	230	400/1500

These units are semi-enclosed, b. brg. motors and part of complete V-S Drive with 40 KW Ind. M. G. Set with 220/440 v. A. C. Motor; exciter and complete control equipment, M. G. and control in steel enclosure.

SYNCHRONOUS CONDENSERS

Qu.	Kva.	Make	Type	Volts	Speed
1	4000	Whse.		4150	600
1	4000	G.E.	TSC	2400/4800	900
1	600	G.E.	ATI	600	900
1	500	G.E.	ATI	480	900

SPECIAL

500 HP—GE—KF-559—3575 RPM—2300 Volt Sq. Cy. Motor connected to Byron Jackson 325 GPM—10 stage, 3500 ft. head pump.

A.C. MOTORS

3 ph. 60 cycle

SYNCHRONOUS

HP	Make	Type	Volts	Speed
2—3500	G.E.	TS	2300	257
1—2100	G.E.	ATI	4600	510
2— 900	Al. Ch.	(New)	2200	150
1— 600	G.E.	ATI	600	900
1— 500	G.E.	ATI	480	900
2— 450	Whse.		2300	1800
1— 400	G.E.	TS	440	600
2— 350	G.E.	TS	2200	150
1— 125	Whse.	32AG	440	514
1— 100	Whse.		550	600
1— 85	G.E.	TS	440	1800

SLIP RING

1—1000	Whse.	CW	2300	700
1— 900	G.E.	IM	2300	80
1— 750	Whse.	CW	2200	327
1— 450	G.E.	I	440	506
1— 350	G.E.	MT-442Y	2200/4000	253
1— 300	Whse.	CW	440	1750
2— 200	G.E.	IM	440/550	435
1— 250	G.E.	MT-424Y	4000	257
1— 100	Al. Ch.	ANY	220	435
1— 75	Whse.	CW-761	2300	1750
1— 75	F.M.	By-H16B	2300	1750
3— 50	Whse.	C1-638A	220	870
2— 50	Whse.	CIW-504	440	870
1— 50	Rel.	1XM	2300	880
1— 50	G.E.	MT-352	550	600

SQUIRREL CAGE

1—700	G.E.	KT	2300	705
1—250	West.	CS-7111	2200	3530
1—250	G.E.	IK	440	600
1—200	G.E.	IK	550	865
1—150/70	G.E.	IK	440	1170/870
1—100	G.E.	IK	2200	600
1—100	G.E.	IK-Vert.	2300	450
2— 75	G.E.	K	2200	1200
1— 50	G.E.	KF-405S	220/440	3550
2— 50	Whse.	CS	220	870
1— 50	G.E.	KT-327	2200	1750
1— 50	Whse.	C-S	440	1755

Turbo Generators

See our advertisement on page 298

SPECIAL

MERCURY ARC RECTIFIERS

1—750 KW—GE—Type RHW—6 Anode 575 V, D.C. Form C with 2300 V, 60 cycle transformer and switching equipment.

1—500 KW—GE—Type RHW—6 Anode 575 V, D.C. Form B with 2300 V, 60 cycle transformer and switching equipment.

40th year BELYEA CO., INC.

OF BUILDING A REPUTATION FOR QUALITY

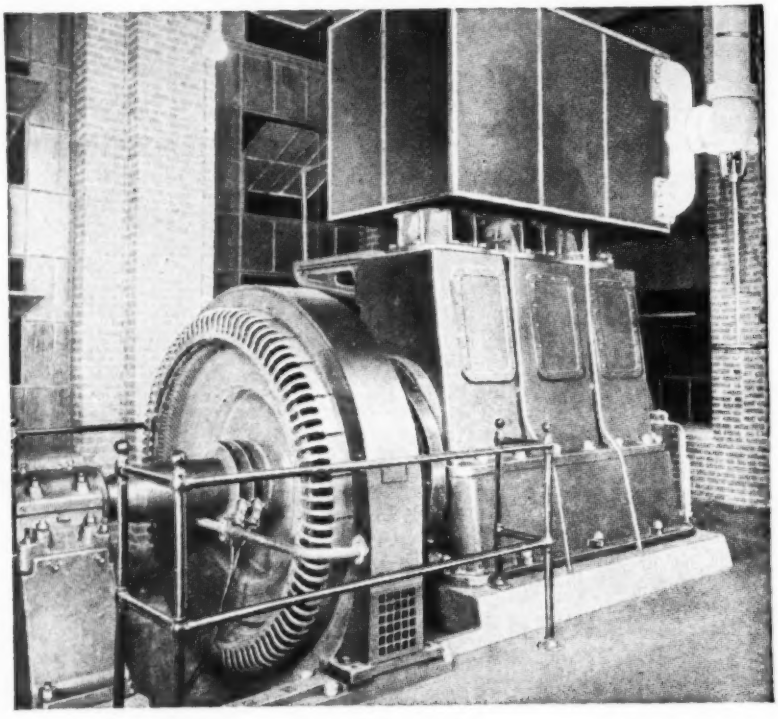
Main Office and Shop

43 HOWELL ST., JERSEY CITY 6, N. J.

Phone—Journal Square 2-3334

Also N. Y. City Line—Rector 2-7150

POWER PLANT MACHINERY - IMMEDIATE DELIVERY



960 I.H.P., 18" diameter x 16" stroke, 3 cylinder, 327 RPM Skinner Vertical Unaflow non-condensing engine, 150 lbs. pressure direct connected to a 750 KVA—600 KW, 80% P.F., 40° C rise, 3 phase, 60 cycle, 2300/600/480/240/208 volts 327 RPM Electric Machinery alternating current generator equipped with a 15 KW, 125 volt, 1450 RPM V-belt Electric Machinery Exciter, Switchboard panel with instruments and General Electric voltage regulator.

← ACTUAL PHOTOGRAPH

EXCELLENT CONDITION
COMPLETE INSTALLATION

TURBINE-GENERATOR UNITS
3 phase, 60 cycle

2500 KVA Westinghouse condensing 180 lbs. pressure, 2300 volts, 3600 RPM complete surface condenser, exciter.
1250 KVA G.E. condensing, 200 lbs. pressure, 2300 volt, 3600 RPM complete exciter, condenser, panel.
625 KVA G.E. non-condensing 150 lbs. pressure, 15 lbs. back, 2300 volts, 3600 RPM complete exciter, panel.
625 KVA Westinghouse automatic bleeder condensing, 250 lbs. pressure, 20 lbs. gauge, 480 volts, complete condenser.
500 KVA Westinghouse non-condensing 150 lbs. pressure, 10 lbs. back 240 volt, complete exciter and switchboard.
375 KVA G.E. condensing, 125 lbs. pressure, 2300 volt, 3600 RPM complete surface condenser and panel.
125 KVA Westinghouse non-condensing, 175 to 200 lbs. pressure, 0-10 lbs. back, 240 volts with exciter, panel.
125 KVA G.E. non-condensing, 175 to 200 lbs. pressure, 10 lbs. gauge back, 2300 volts, 3600 RPM complete.
120 KVA G.E.-Moore non-condensing 250 lbs. pressure, 7 lbs. gauge back, 240 volts, complete with switchboard.
100 KVA Westinghouse non-condensing, 125 to 150 lbs. pressure, 10 lbs. gauge back 2400/600 volts, 3600 RPM.

ENGINE-GENERATOR UNITS
ALTERNATING CURRENT—3 phase, 60 cycle

500 KVA Westinghouse 600 volt, 514 RPM Generator.
375 KVA G.E. 2300/480 volt, 180 RPM Generator direct connected to 21"x24" Chuse non-releasing Engine.
250 KVA (2) G.E. 2300/440/240 volts, 200 RPM generators each direct connected to 21" x 22" Skinner Universal engine.
200 KVA Crocker Wheeler 240 volts, 400 RPM generator direct connected to Ames Unaflow engine.
225 KVA E.M. 2300 volts, 200 RPM generator direct connected to 19"x24" Chuse Unaflow poppet valve engine.
187 KVA G.E. 2300 volt, 225 RPM Generator direct connected to 15"x19" Chuse non-releasing Engine.
180 KVA G.E. 240/440 or 550 volts, 200 RPM generator direct connected to 18"x21" Chuse non-releasing Corliss engine.

ENGINE-GENERATOR UNITS
DIRECT CURRENT

400 KW Maximum, Crocker Wheeler 125 volt, 300 RPM Generator direct connected to Skinner Unaflow Engine.
250 KW, Crocker-Wheeler 250 volt, 257 RPM generator direct connected to 360 HP, 6 cylinder late type Fairbanks-Morse full Diesel engine—complete.
200 KW (3) New General Electric 120 volt Marine type turbine generator units.
200 KW Burke 3-wire, 250 volt, 360 RPM generator direct connected Ames 4 cylinder vertical Unaflow non-condensing engine, 150 lbs. pressure complete switchboard.
200 KW G.E. 125 volt, 200 RPM generator direct connected Skinner Unaflow engine.
150 KW Westinghouse 250 volt generator direct connected to Ames Unaflow engine.
75 KW Allis Chalmers-Terry, 125 volts, 2400 RPM 150 lbs. pressure non-condensing turbine generator unit.
60 KW (3) *New* Westinghouse 120 volt Marine type turbine generator units.
35 KW G.E. 125 volts, turbine-generator unit.

MOTOR GENERATOR SETS

1500 KW Allis-Chalmers 550/600 volts, 300 RPM direct current generator direct connected 2190 HP, 3 phase, 60 cycle, 4000/6600 volts synchronous motor.
500 KW Allis 250 volt, 1200 RPM direct current Generator direct connected to 3 phase, 60 cycle, 4000 volts Synchronous Motor.
300 KW Allis 250 volt, 600 RPM direct connected 3 phase, 60 cycle, 4000/2300 volts Synchronous Motor.
62½ KVA G.E. 3 phase 60 cycle, 2300 volts, 1200 RPM alternator direct connected 75 HP, 115 volts direct current motor.
50 KW Westinghouse, 125 volt, direct current generator direct connected 75 HP, 3 phase, 60 cycle, 2300 volt motor.

Utilities Electrical Machinery Corporation
600 NATIONAL CITY BANK BLDG.
CLEVELAND 14, OHIO
WIRE OR PHONE
LONG DISTANCE 422

Reliably Rebuilt—YEAR Guarantee

A. C. Motors Generators

Squirrel Cage Motors

H.P.	Make	Type	Speed
300	West.	CS-875S	1700
200	Al. Ch.		600
150	El. Mchn		1200
150	Al. Ch.		514
147	West.	25 cy.	715
125	Cent.		1150
125	El. Prod.	B.B.	1150
125	G.E.	TEFC	1200
125	Al. Ch.		450
100(3)	G.E.	XP	900
100	G.E.	TEFC	900
100	G.E.		1200
100	Al. Ch.		680
75	Al. Ch.		3600
75	G.E.	IK	1800
75	G.E.	KT-347	1200
50	G.E.	KF-504	1150
50	Ideal	A	1150
50	G.E.	Class 2G	1200
50	West.	XP	900
40	G.E.	XP	1800
40	G.E.	XP	900
30	West.	CS-445	875
25	West. (2)	3S-364	3450
25	G.E.	XP	1200

Slipring Motors

600	Cr. Wh.		514
150	G.E. (2)	IM	600
100	Al. Ch.		695
100	Wagner	25 cy.	480
75	G.E. (2)	IM	690
60	G.E.	TEFC	720
50	Al. Ch.	ARY	600
50	G.E. (2)		514
40	G.E.	IM	1200
40	G.E.	MT-352	600
30	West. (2)	CI	900
30	G.E.	MT-542	720

Synchronous Motors

600	G.E.	900
150	Cr. Wh.	900
50	G.E.	1200

Generators

KW	Make	Speed
150	G.E.	600
100	West.	600

D.C. to A.C. Gen.

Size	Make	D.C.	A.C.
25	Star	115	120
25	Ideal	115	440
25	El. Mchy.	230	440
7½	Hertner	115	440
5	El. Spec.	110	110

D. C. Motors

230 V. Variable Speed

H.P.	Make	Type	Speed
100	Rel.	1050T	400/1000
100	G.E.	CD173	400/1200
75	Cr. Wh.	CMC	375/750
60	G.E.	C	480/1100
50	West.	SK	500/1500
40	G.E.	CD	500/1500
35	G.E.	RF	500/1500
25	G.E. (3)	RF12	500/1500
25	West.	SK140	400/1200
20	G.E. (2)	RF12	400/1200
15	West.	SK93	600/1200
15	E.D.	10S	500/1500
15	West.	SK	250/1500
10	G.E.	RF10	600/1800
10	West.	SK	600/1200
10	G.E.	RF	400/1600
10	G.E.	RF	400/1200

230 V.

350	Al. Ch.		500
100	G.E.	CDP	1750
60	West.	SK160	680
50	West.	SK133	1300
50	Diehl	K10	850
50	West.	SK	750
40	G.E.	RC	1750
40	West.	SK103	1750
40	G.E.	RC	1075
40	G.E. (2)	DLC	1050
35	West.	SK	1150
30	G.E.	RC	1100
30	West.	SK	975
25	Rel.	92T	1150
25	West. (4)	SK113	860
25	E.D.	10S	800
20	West.	SK60	1750
20	West.	SK83	1750
20	G.E.	CD	1200
20	Star (2)	SHB30	29

115 V.

25	Star	SQ15L	2400
25	G.E.	CDM85	1800
25	G.E.	CDM95	1200
20	G.E.	CD83	1750
20	West.	SK110L	750
10	L.A.	ONA284	3500

D. C. Generators

600 V.

KW	Make	Speed
200	Cr. Wh.	900
30	Burke	1750
30	E.D.	1150

250 V.

KW	Make	Speed
330	Elliot	1200
300 (2)	G.E.	1200
150	West.	900
150	West.	1180
150	G.E.	600
50	G.E.	1200
40 (2)	G.E.	1750
30 (3)	G.E.	1750
30	Cont.	1200
25	G.E.	1200
15	G.E.	1750
10	Star	1750
7½	West.	1200
5	West.	1750

125 V.

KW	Make	Speed
250	G.E.	720
100 (2)	West.	900
100	G.E.	1200
50	Sturt.	2800
40	Cent.	1450
20	Delco	1200
15	G.E.	1150
10	Rogers	1450
7½	West.	1200
5	G.E.	1750

Low Voltage

Amps.	Make	Voltage
5000	Col.	6/12
2000	H.V.W.	6/12
1000	Col.	6/12
1000	H.V.W.	12/24
750	Star	15
1000	G.E.	15
600	Rel.	24
800	G.E.	33
1600	G.E.	30
800	G.E.	50
1200	G.E.	32
800	G.E.	30
100	G.E.	75
160	Cent.	75
1500	West.	90

Miscellaneous

Pyrometers

40—Leeds & Northrup Model C-S & R.

D.C. Starters

150—230 V. Cutler-Hammer, D.C. automatic, 5 H.P. to 75 H.P.
100—230 V. Cutler-Hammer, manual, 1 H.P. to 3 H.P.
250—5 H.P. 115 V. Cutler-Hammer, magnetic.
75—1½ H.P. 230 V. General Electric, compound.
40—7½ H.P. 230 V. Cutler-Hammer reversing magnetic.

A.C. Starters

1—250—H.P. 4150 V.
1—150/200 H.P. G.E. Red, Volt. 440 V. Synchronous Starter.
40—Magnetic multi-speed A.C.
40—50 H.P. Cutler-Hammer up to 25 H.P. 440 V.
300—25 H.P. Ward-Leonard, 440 V.
1100—7½ H.P. Cutler-Hammer, 440 V.

Air Compressors

10x6 Gardner, 30 lbs.
12½x12 American, 125 lbs.

Pumps

LeCourtney—5 stage, 675 GPM, 1100 ft. head.

M.D. Blowers

50—1200 CFM—American, 3" static.
100—3000 CFM—U.S., 3" static.
75—200 CFM—Bayley, 2" static.
2—½ H.P. Spencer.

230 V. D.C. Monorail Hoist

17—4000# Shepard
1—4000# Cleveland
1—3000# Shepard
1—3000# Cleveland
2—2000# Harnishfeger
2—2000# Shepard

A.C. Starters

8—½ to 20 KVA.

Meters

20—Weston Portable—A.C. and D.C. Model 155.

ONLY PARTIAL LIST—SEND FOR No. 11

EST. 1910 → L. J. LAND INC. ← 37TH YEAR

146 GRAND STREET, NEW YORK 13, N. Y.
PHONE: CAnal 6-6976

New England Representative:
BOSTON, MASS.
411 Atlantic Ave.
Phone: Liberty 4300

South Western Representative
HOUSTON, TEXAS, 1400 Carr St., Phone: Charter 4-6558

Pennsylvania Office
READING, PENNA.
10th & Exeter Sts.
Phone: Reading 2-6866

Motors

. . . always a wide selection . . . always unusual values

Listed below a few of the motors available in a hurry from Wente

SQUIRREL CAGE
3 Phase, 60 Cycle, 220 or 440 Volt
(Other voltage as noted)

Qu	HP	Make	Type	Speed
1	350	G.E.	KF Vert.	3600
1	200	G.E.	K-566, 2300 Volt	720
1	250	F.-M.	HF, 2200 Volt	720
1	150	Al. Ch.		1750
2	125	Ch. Wh.	126Q	430
6	125	Al. Ch.	AR, ball bearing	450
1	120	G.E.	FT	3600
3	75	F.-M.	H, ball bearing	600
1	60	Reliance	AA	900
2	50	R.&M.	L	1200
1	50	Al. Ch.	AN	900
1	50	G.E.	I 2200 Volt	900
1	50	G.E.	I	720
1	50	Wagner	BM	495
1	50	Al. Ch.		490
2	40	F.-M.	B, ball bearing	900
1	40	F.-M.		600
2	35	Al. Ch.	2 phase	900
1	35	Al. Ch.	B	900
1	30/30	West.	CS TEFCBB 1800/900	
1	30	F.M.	QZK Open BB	1200
1	30	Cr. Wh.		900
2	30	Al. Ch.	AS 2 Phase	900
1	30	Century	AS	720
1	25	Howell		1200
1	25	F.M.	QZK B.B. New	1200
1	25	Wagner	BP	1200
1	25	Burke	EM3	900
1	25	Lincoln		900
1	25	Al. Ch.	AN	720
1	25	G.E.	M10	720
2	20	U.S.	SC SP B.B.	1800
2	20	F.M.	QZK B.V. New	1800
1	20	West.	CS	1800
1	20	Howell	N. Vert. B.B. New	1200
1	20	F.M.	KRV	1200
1	20	Cr. Wh.		900
1	20	G.E.	I-K 2200 Volt	900
1	20	Cleve.	M	900
1	20	Al. Ch.		900
1	18	West.	MS (Elev.)	720
1	15	F.M.	HLS	3600
4	15	F.M.	QZK B.B. New	1800
1	10	Al. Ch.		1200
1	10	Imperial EH B.B.		1200
5	7½	G.E.	KT	1800
1	7½	West.	CS	1800
3	7½	Wagner	11VRW	1800
5	7½	G.E.	KT	1200
15	3	Imperial E (New)		1200

Approx. 200 New motors from 2 HP—30 HP.

SLIP RING & SYNCHRONOUS
3 Phase, 60 Cycle, 220 or 440 Volt
(Other voltage as noted)

Qu	HP	Make	Type	Speed
1	443	El. M.	Syn.	900
1	100KW	G.E.	ATB Syn.	900
1	100	G.E.	I-16 2200 Volt	450
1	100KVA	G.E.	TRB Syn.	600
1	75	F. M.	BV 2200 Volt	1800
1	75	West.	(New) Syn.	1200
1	60	Ideal	AVX	1200
1	50	G.E.	I 25 Cycle	700
1	50	Al. Ch.		720
1	50	Ideal	AV 2200 Volt	600
1	40	West.	CW	1160
1	40	G.E.	MT	1200
1	40	Al. Ch.		1200
1	40	G.E.	MT	900
2	40	West.	CW 2200 Volt	900
2	40	West.	CW	900
2	40	Al. Ch.		900
1	40	West.	CI	730
1	40	Burke	EMV7	1150/550
1	35	Al. Ch.		720
1	35	G.E.	I-12	600
1	30	Al. Ch.	2200 Volt	720
1	25	Cr. Wh.		1200
1	25	West.	CW	720
1	25	West.	MW	720
1	25	G.E.	MT Tot. Encl.	600
1	25	G.E.	MT	400

DC—230 Volt
(Other voltage as noted)

Qu	HP	Make	Type	Speed
1	150	West.	SK184	850
1	130	Cr. Wh.	CMC 550 Volt	1200
1	125	West.	SK	600
1	100	G.E.	CD	1200
1	100	West.	SK	1800
4	100	Cr. Wh.	CMC	225/550
1	75	Diehl	K11	700
1	60	West.	SK 115 Volt (Vert.)	1200
3	50	West.	SK	1200
1	40	Rel.	440 Volt B.B. Vert.	1800
1	40	Rel.	440 Volt B.B. (Vert.)	1200/1800
1	25/40	Cr. Wh.	CMC 440 Volt (Vert.)	1200/1800
1	40	Rel.	B. P.	400/1500
2	40	West.	SK	1200
1	40	G.E.	RC	1200
7	40	West.		775
1	35	G.E.	OMTEBB	1300
1	35	West.	SK	1200
1	35	Al. Ch.		1200
1	35	G.E.	DLC	700
2	30	El. Dy.	158	625/1250
5	30	Rel.	92TF	1800
1	30	Rel.	131 440 Volt (Vert.)	1200
1	30	G.E.	RC	1200
1	30 KW	Al. Ch.	110 Volt	925
1	27½	G.E.	CVC116	1800
1	25	Cr. Wh.	CM 110 Volt	900/1200
1	25	Al. Ch.	E120	500/1500
1	25	Rel.	25P	250/1000
1	25	G.E.	RF	300/900
1	25	F.M.	IRC	400/800
6	25	West.	SK	1200
7	25	West.	SK	850
2	20	Rel.	131T	1000/2000
2	20	West.	SK	750/1500
1	20	Diehl	K9	500/1000
1	20	G.E.	CD	400/1600
1	20	G.E.	RF	250/1000
1	20	Lincoln	FKW B.B.	1800
6	20	Cr. Wh.	CMC Enclosed	1800
1	20	Cr. Wh.	CMCTEBB (Exp.)	1200
1	20	Rel.	92T	1200
2	20	West.	SK	1200

DC—230 VOLT

Qu	HP	Make	Type	Speed
1	20	West.	SK	900
1	20	G.E.	RC	900
7	20	West.	SK	750
1	20	West.	SK	500
1	15	West.	SK63	1800
1	15	West.	SK113 Encl.	1800
1	15	F.M.	D B. B.	1150
6	15	Rel.	66T	1150
2	15	Cr. Wh.	CCM	1150
1	15	Cr. Wh.	CCM Tot. Encl.	1500
1	15	West.	SK83	1150
2	15	West.	S680L	1150
1	15	G.E.	CD	1150
1	15	West.	SK90	850
1	15	West.	KS Crane	630
8	15	Rel.	92F	850/1700
2	15	G.E.	CO Crane	650/2700
1	15	Rel.	131T 115v	600/1500
2	15	West.	SK	600/1200
1	15	Rel.	78T	400/1600
1	15	G.E.	RF11	400/1200
1	12½	West.	SK	750/1500
1	12	G.E.	RF	575/1725
1	10	West.	SK7	850/1700
2	10	G.E.	RF10	600/1800
1	10	West.	SK90	600/1800
7	10	West.	SK80L	500/1500
20	10	Al. Ch.		500/1000
1	10	Rel.	92TF	400/1000
1	10	West.	SK	250/1000
6	10	Cr. Wh.	CM TEBB	1800
1	10	Century	R304	1800
15	10	West.	SK	1150
2	10	West.	SK 115 Volt	1150
3	10	Rel.	46TF	1150
1	10	G.E.	RC9	1150
2	10	Rel.	66TF	850
2	10	G.E.	RC	850
3	10	West.	SK70	850
1	10	G.E.	RC29 550 Volt	850
1	10	Colonial		950
14	7½	West.	SK33	1750
4	7½	West.	SK60	850
20	5	West. & Gen. Elec.		1750
20	5	West. & Reliance		1150
35	5	West.	SK43	850

Hundreds of other DC motors not listed

27—New vertical, T.E.F.C.B.B., 3 Ph., 60 Cy. 220/440 volt as follows:
1—Fairbanks-Morse, 3 HP. ty. QZCU, Fr. 254, 1200 RPM Exp.
2—General Electric, 3 HP. ty. K Fr. 254, 1200 RPM
8—General Electric, 7½ HP. ty. Fr. 324, 1200 RPM
8—Delco, 7½, type C, Fr. 324, 1200 RPM
1—Howell, 7 HP. type KV., Fr. 284, 1800 RPM
5—General Electric, 15 HP. type K. Fr. 365, 1200 RPM
2—Howell, 15 HP. type KV. Fr. 365, 1200 RPM

6—New Reliance, 30 KW, variable voltage M-G sets, 250 volt DC, 220/440 volt AC, 3 phase, 60 cycle, 1800 RPM, complete with exciters, all control and drive motors. All motors ball bearing, inclosed; M-G set, exciters and control mounted in fan cooled inclosure.

1—1000 KW, General Electric, synchronous M-G set, 4600 volt AC, 275 volt DC, condition excellent—immediate delivery—complete data on application.

1—150 KW General Electric M-G set 250/275 volt DC, 440 volt AC, 3 phase, 60 cycle, 900 RPM
1—100 KW Ridgeway synchronous M-G set, 250 volt DC, 2300 volt AC, 3 phase, 60 cycle, 1200 RPM with AC control & DC panel
1—200 KW Burke synchronous M-G set, 250 volt DC, 440 volt AC, 3 phase, 60 cycle, 900 RPM with AC control & DC panel
1—100 KW, Westinghouse, synchronous M-G set, 250 volt DC, 220 volt AC, 3 phase, 60 cycle, 1200 RPM, AC control and DC panel
1—50 KW, Westinghouse M-G set, 230 volt DC, 220 volt AC, 3 phase, 60 cycle, 1200 RPM, AC control and DC panel

6—Practically new 40 KW Reliance & General Electric variable voltage M-G sets, 250 volt DC, 220/440 volt AC, 3 phase, 60 cycle, 1800 RPM, complete with exciters all control and drive motors. All motors ball bearing, enclosed M-G set, exciters and control mounted in fan cooled enclosures. Drive motor G.E., type CD, frame 1441, 40 HP, 230 volt 400/1600 RPM, enclosed, ball bearing, 50° Cont 250 RPM, 1 hr. 50°

The Wente Electric Co.

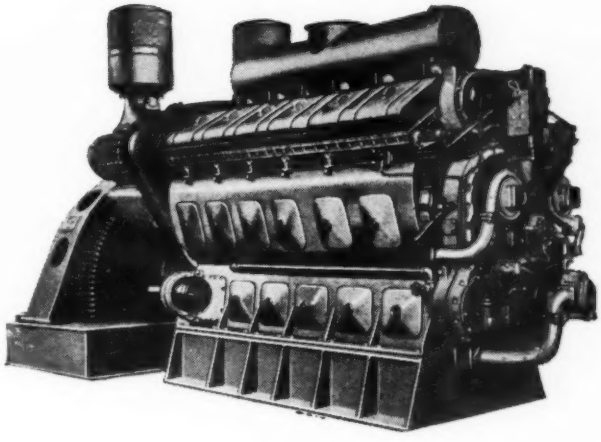
Hamilton — *Rebuilt Motors and Generators Since 1906* — **Ohio**

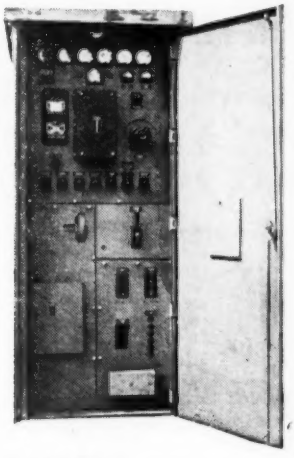
PHONE HAMILTON 707

DIESEL POWER PLANTS

OFFERED FOR QUICK DELIVERY

FROM AGSCO





900 KVA GENERAL MOTORS DIESEL ENGINE MODEL 12-567
WITH DIRECT CONNECTED G.E. ALTERNATOR, 3 PHASE, 60 CYCLE, 2300 VOLTS

• 50 AND 60 CYCLE OFFERINGS •

ALTERNATING CURRENT DIESEL GENERATORS

KVA	Make	HP	Model	RPM
1250	General Motors	1600	16-278A	720
1250	Fairbanks Morse	1600	38D8⅛	720
1250	Cooper Bessemer	1500	LS-8	327
900	General Motors	1200	12–567	720
625	Superior	750	OS	327
625	General Motors	750	8-278A	720
563	De La Vergne	675	VO	600
375	Worthington	450	HD-6	450
312	General Motors	450	8-268A	1200
300	Fairbanks Morse	360	YVA	257
250	General Motors	350	8-268A	1200
136	Fairbanks Morse	150	32E14	300
125	General Motors	145	3-268A	1200
100	Buckeye	150	E	327
94	General Motors	160	6045A	1800
62	Inter. Harvester	76	UD-18	1200
37	Inter. Harvester	45	UD-14	1200

DIRECT CURRENT DIESEL GENERATORS

KW	Make	HP	Model	RPM
1000	Fairbanks Morse	1600	38D8⅛	720
660	Cooper Bessemer	950	LS	327
500	General Motors	750	8-278A	720
300	Baldwin	450	VO	400
250	Worthington	450	HD-6	450
100	Superior	150	GDB-8	1200

Engineered AGSCO DIESEL POWER

A. G. SCHOONMAKER Company, Inc. ESTABLISHED 1898

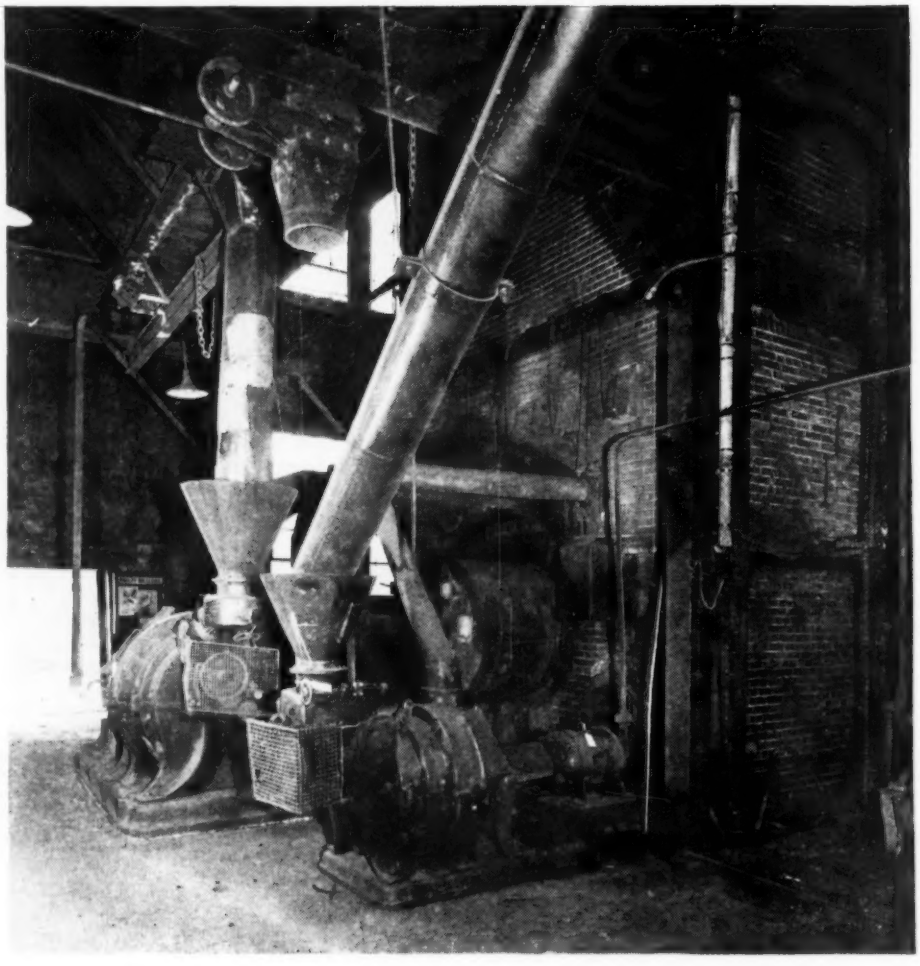
Diesel Engines • Power Machinery

50 CHURCH STREET, NEW YORK 7, N. Y. PHONE DIgby 9-4350

COMPLETE BOILER PLANT

45,000 lb. per hour capacity

FOR IMMEDIATE DELIVERY



1—Erie City Watertube Boiler, 45,000# per hour capacity, ASME Code and National Board stamped, 3 Drum, designed to operate at 180#; 504—3¼" tubes. Pulverized coal fired with:

1—Erie City Unitype Pulverizer, type C, for 4500# coal per hour. Driven by 60 H.P. Armor Electric Motor, 3/60/440 volts, with Starter.

1—Patterson Kelly Feed Water Heater.

1—Union Steam Co. Boiler Feed Pump size 12" x 7" x 12".

1—Coal Conveyor, Link Belt Bucket Elevator, housing 12½" x 33", 46' centers. Buckets every link, single chain, motor driven by 10 H.P. Motor, 3/60/440 volts, with Starter.

1—Steel Coal Bin, 31'6" long x 15'4" wide x 14'6", overall height, with bottom tapering 6'6" high to 24" wide. 6—15" discharge spouts and dump gates.

In addition, there is an Erie City Unitype Pulverizer, size A, for use at low loads 1250# capacity/hour, driven by 30 H.P. Westinghouse Motor 3/60/440 volts. This unit can be purchased with or without the additional Pulverizer.

IN EXCELLENT CONDITION—ALMOST NEW

Heat and Power Co., inc.

70 PINE STREET | **DIGBY 8-0373** | **NEW YORK 5, N. Y.**

GLOW

SQUIRREL CAGE MOTORS

HP	RPM	Volts	Make
350	514	440	GE-I
250	600	2300	Triumph
223	3600	4150	GE-FR
125	340	220	A-C
100	514	220	A-C
100	450	220	A-C
75	720	2300	Wagner
75	360	220	GE-I
60	3600	2300	GE-KT
50	720	2300	Wtg.-CS
40	900	2300	Wtg.-CS
35	600	220	FT. Wayne
30	720	220	GE-HI
25	900	220	GE-FTR
25	900	220	Wtg.-CS
25	720	220	Wagner
25	600	440	GE-I
20*	1800	220/440	F-Morse
20*	1200	2300	F-Morse
20	900	440	Wtg.-CCL
20	900	2300	Wtg.-CS
20*	1800	220/440	Master
15	3600	220	GE-KT
15	1800	220	Wtg.-CS

ENCLOSED SQUIRREL CAGE

HP	RPM	Volts	Make
125*	1200	440	GE-TEFC-BB
7½*	1800	dual	Wagner-TEFC-BB
7½*	1800	dual	Master-TEFC-BB
7½	1200	dual	GE-Hi Slip-TEFC-BB
7½	1090	220/440	GE-KR, high slip
5*	1800	dual	Master-TEI C-BB
5	1800	220	Wagner TF-BB
5*	1200	dual	GE-TEFC-BB
3	3600	440	Wtg.-TE-BB
3	1800	dual	Delco-TEFC-BB
3	1200	dual	Rel-TEFC-BB
2	1200	220	GE-TE-BB
2	900	220	Wagner-TE-BB
2	1800	dual	Delco-TEFC-BB
1½	900	dual	Delco-TEFC-BB
1½	1800	dual	L. Al.-TE-BB
1½	1200	dual	Ref-TE-BB
1	3600	220	Haskins-TEFC
1	1800	dual	Master-TEFC-BB
1*	1800	dual	Delco-TE-BB
1*	1200	dual	Rel-TE-BB
¾	3600	440	Delco-TE
¾	1800	dual	Wesche-TE-BB
¾	3600	220	Ohio-TE-BB
¾	1800	440	Wtg.-TE-BB
¾*	1800	dual	Delco-TE-BB
¾	1200	220	Cr. Wh.-TE
¾	3600	440	GE-TE
¾	1800	220	Delco-TE-BB
½	1800	440	Delco-TE-BB
½	1200	440	Wtg.-TE-BB

* New Motor

SLIP RING MOTORS

HP	RPM	Volts	Make
500	900	440	GE-3 Brg.
400	1200	2300	Al. Ch.
400	900	440	GE-IM
375	1800	2300	Al. Ch.
235	1800	220	GE-I
250	300	2300	Al. Ch.
200	514	440	Triumph-C
75	360	220	GE-I-M
60	1800	dual	Al. Ch.
60	900	2300	Burke
60	900	220	Wesche
50	900	2300	Ridgeway
50	900	440	Wagner
50	720	440	Al. Ch.
40	1200	220	Wtg.-CW
40	900	2300	Al. Ch.
40	900	220	Wtg.-HF
40	720	2300	Wtg.-HF
40	720	220	Al. Ch-ANY
40	600	2300	Al. Ch-ANY
40	600	220	Al. Ch-ANY
40	450	220	Triumph-C
35	900	2300	Ridgeway
35	720	220	GE-I
30	1800	2300	Wtg.-CW
30	1200	2300	Lincoln
30	900	220	GE-MT
30	900	2300	Ridgeway
30	720	220	GE-I
30	600	220	F. Morse-BV
30	1200	440	Wagner
25	1200	2300	Al. Ch.-ANY
25	900	220	GE-MT
25	720	dual	Watson-KH
20	1800	440	Al. Ch.
20	900	2300	GE-I
20	565	440	Wtg.-HF

VERTICAL MOTORS

HP	RPM	Volts	Make
200	1200	440	Al. Ch.-Sat
150	1200	2300	GE-SR
150	1200	440	GE-Cage
125	1200	2300	Al. Ch.-Cage
100	1200	440	GE-Cage
75	1200	2200	GE-Cage
75	360	220	Ideal-Cage
60	1800	230 D.C.	GE
60	1200	440	Al. Ch.-Cage
50	1800	440	GE-Cage
50	1200	2200	Wtg.-Cage
50	600	440	Al. Ch.-Cage
40	1800	220	GE-Cage
40	1700	230 D.C.	GE
40	1200	440	Wtg.-SR
40	1200	220	GE-Cage
40	950	230 D.C.	Wtg.
35	1800	440	GE-Cage
35	1200	2300	Al. Ch.-Cage
35	450	440	GE-Cage
30	1200	dual	Wtg.-Cage
25*	1550	230 D.C.	GE
25	1200	2200	GE-Cage
25	850	230 D.C.	Wtg.
20	1200	440	Al. Ch.-Cage

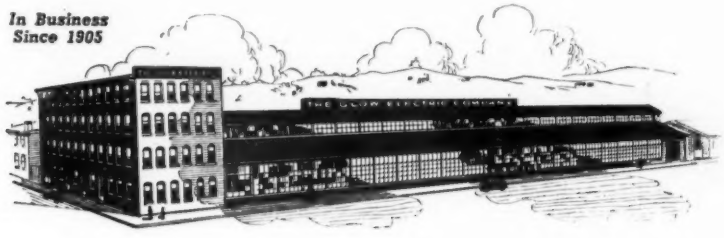
VERTICAL MOTORS—Cont'd.

HP	RPM	Volts	Make
20	800	230 D.C.	GE
15*	1800	440	Al. Ch.-Cage
15	1750	110 D.C.	Wtg.
15	1150	230 D.C.	GE
15	600	440	Al. Ch.-Cage
12½	900	220	L. Al.-Cage
10	3400	230 D.C.	Wtg.
10	900	220	Wtg.-Cage
7½	1800	500 D.C.	Peerless
7½	900	440	Burke
7½	700	230 D.C.	GF-Cage
6	850	110 D.C.	Rel.
5	1400	230 D.C.	R. & M.
5	600	440	GE-Cage
4	1650	110 D.C.	Watson
3	1700	230 D.C.	Watson
3	1200	dual	Wtg.-Cage
3	900	440	Wtg.-Cage
3	600	dual	Wtg.-Cage
2	1800	230 D.C.	GE
2	1800	220	L. Al.-Cage
2	1180	230 D.C.	Wtg.
2	900	220	GE-Cage
1	1200	220	GE-Cage

SYNCHRONOUS MOTORS

HP	RPM	Volts	Make
710	720	13200/6600	GE-ATI
250	225	2200	GE
250	225	440	GE
200	225	2200	Wtg.
175	225	208	GE
160	660	440	GE
160	164	440	GE
120	225	220	E-M
115	164	208	GE
60	360	2200	GE
50	360	440	GE
30	900	440	Wagner
30	600	550	GE
30	450	dual	Wtg.
30	360	550	GE
30	327	220	E-M
25	1800	220	Wagner
25	450	220	E-M
25	300	220	Ideal
20	900	220	Wtg.
20	600	220	E-M
15	1800	220	Wagner
10	1800	220	Wagner
10	1200	220	Wagner
7½	1200	440	Wagner

In Business Since 1905



TRANSFORMERS

General Electric Spirakore Transformers, 167 KVA, 2400/4160Y volt primary, 120/240 volt secondary, 1 phase, 60 cycle, oil cooled, outdoor type. Alternative same except secondary 240 or 480 volt.

DIRECT CURRENT GENERATORS

KW	Volts	RPM	Manufacturer	Description
400	120/240	300	Westinghouse	Compound, Interpole Pedestal Bearings
200	250	375	Jantz & Leist	Compound Wound, Pedestal Bearings
175	250	450	Westinghouse	Compound Wound, Pedestal Bearings
80	125	500	Jantz & Leist	Compound Wound, Double Shaft Extension
80	125	400	Jantz & Leist	Compound Wound, Double Shaft Extension
30	250	300	Triumph	Compound Wound
22½	250	765	Westinghouse	Compound Wound

MOTOR GENERATOR SETS

KW	Volts	Generator Mfgr.	A. C. Motor
500	600	General Electric	710 HP, 1 P.F., 720 RPM, 13200/6600 Volts, Genera Electric Synchronous
200	230/250	Crocker-Wheeler	300 HP, 1 P.F., 600 RPM, 2300 Volts, Allis-Chalmers, Synchronous
200	125	General Electric	300 HP, 900 RPM, General Electric, Synchronous
50	120/125	Burke	95 HP, 1200 RPM, Burke, Synchronous
40	250	Reliance	60 HP, 1800 RPM Century, Induction
25	125	General Electric	35 HP, 1200 RPM, General Electric, Induction

ELECTRIC CO

AC & DC MOTORS • GENERATORS • PUMPS
SYNCHRONOUS MOTORS • CONTROL EQUIPMENT
MOTOR GENERATOR SETS • ELECTRIC EQUIPMENT
STEAM ENGINE GEN. SETS • SLIP RING MOTORS

927 HARRIET ST.
PHONE MA. 3024
CINCINNATI 3, OHIO

SPECIAL

10/20,000# per Hr.-200#—New-Wickes 3 drum, low head—Never installed.

30,000#/Hr.-450#—New Bros integral furnace-stoker or oil—Never installed.

BOILERS—WATER TUBE

1038 H.P. 200# Sectional Header, pulverizers, Springfield, 1927
750 H.P. 250# 4-drum, stoker, Union Iron Works, 1927
424 H.P. 425# Integral furnace, pulverizers, B&W, 1940
350 H.P. 225# Stirling, stoker, B&W, 1926
253 H.P. 180# Longitudinal drum, oil burner, Erie City, 1926
2—100 H.P. 160# 2-drum, Detroit stokers, Erie City, 1941

TURBO GENERATORS—CONDENSING

4000 KW 2400v. 425 isp. Surf. Condenser & auxs. (2 of these)
4000 KW 2300v. 160# Wemco 1912
2500 KW 2300v. 175# Wemco 1914
1500 KW 2300v. 150# G.E. 1922
1250 KW 2300v. 200# A.C. 1924
2-750 KW 2300v. 150# G.E. 1915
500 KW 2300v. 250# Wemco 1926
6000 KW 600/6600v. 175# G.E. 1917
2000 KW 600v. 155# G.E. 1922
1000 KW 600v. 250# G.E. 1925
300 KW 480v. 400# G.E. 1942
500 KW 240v. 175# Terry S/N 7500

TURBO GENERATORS—CONDENSING EXTRACTION

3000 KW 2300v. 150#-10# Wemco 1915
500 KW 480v. 150#-10# Moore 1928

TURBO GENERATORS—NON-CONDENSING

1500 KW 2300/4000v. 200#-12# Wemco 1912
1400 KW 2400v. 175-10# A.C. Rebuilt 1942
1000 KW 2400v. 175#-10#A.C. Rebuilt 1942
500 KW 2400v. 150#-10# G.E. 1919

MOTOR GENERATOR SETS 60/3 (with controls)

1420 H.P. 11000 volts to 1000 KW 600 volts 900 RPM
1400 H.P. 4000 volts to 1000 KW 600 volts 720 RPM
710 H.P. 2300 volts to 500 KW 600 volts 720 RPM
900 H.P. 480 volts to 300/600 KW 250 volts 1200 RPM
2300 volts to 500 KW 250 volts 514 RPM
300 H.P. 2300 volts to 200 KW 250 volts 600 RPM
75 H.P. 220/440 volts to 50 KW 115/230 volts 1800 RPM
100 H.P. 2300 volts to 65 KW 125 volts 1160 RPM
290 H.P. 440 volts to 192 KW 40/80 volts 1200 RPM

ROTARY CONVERTERS with transformers & controls

60/3/4000/13200 volts to 1500 KW 600 volts 720 RPM
60/3/9900/11000 volts to 1000 KW 600 volts 360 RPM
60/3/11000 volts to 500 KW 600 volts 600 RPM (4 units)
60/3/13200 volts to 1000 KW 250 volts 360 RPM (2 units)

TRANSFORMERS 60 cycle

2—8000 KVA, 26400 to 13200 volts (auto, 3 phase)
3—3000 KVA, 22000 to 2300/4000 volts
3—1000 KVA, 11000 to 2300 volts
3— 125 KVA, 11500 to 2300 volts
3— 150 KVA, 11000 to 220/440 volts
3— 100 KVA, 7200 to 120/240 volts
2— 75 KVA, 4160/7200 to 120/240 volts
3— 167 KVA, 2400/4160 to 120/240 volts

Two 10,000 KVA Substations, 33 KV to 6900/11950 secondary; one 15000 KVA Substation, one 32 KV to 7200/12470 secondary. Several 667 KVA, 33 KV to 2400/4160; and about 40,000 KVA in smaller Units, primaries 6900, 7200 and 12470.

FURNACE TRANSFORMERS 60 cycle, three phase

34000 to 220/85 volts, 1000 KVA
34000 to 164/133 volts, 1000 KVA
22000 to 228/92 volts, 4000 KVA
22000 to 260/101 volts, 4000 KVA
13200 to 240/95 volts, 5000 KVA
13200 to 239/85 volts, 4000 KVA
13200 to 239/85 volts, 3000 KVA
13200 to 239/85 volts, 2000 KVA
12000 to 230 volts, 1500 KVA
4600 to 187/75 volts, 200 KVA
230 to 120/60 volts, 200 KVA

PAUL STEWART & CO., INC.

UNION TRUST BUILDING **CINCINNATI 2, OHIO**

Over 50 Years of Service

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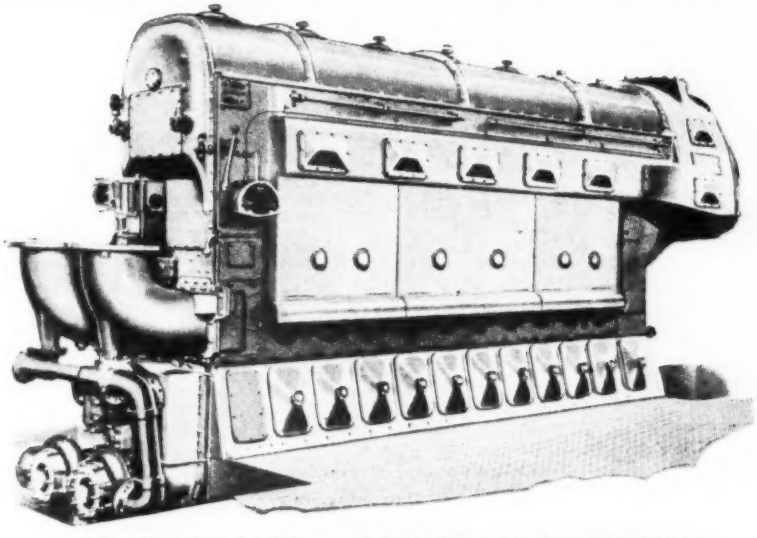
Other Specialties: Diesel Power, Boilers, Genl. Power Plant Equipment

DIESEL POWER IN STOCK: IMMEDIATE SHIPMENT



12—Fairbanks-Morse 1800-HP., Model 38D8-⅛

12—Fairbanks-Morse 100-KW Aux. Diesel Engines
4—400 Enterprise 400-RPM., 6-Cyl., Latest Model—NEW
1—1800-HP., G.M., Diesel Engine—NEW
3—800-Hamilton Diesels, Generators, NEW, Never Used
12—150-HP., G.M., Diesel Engine-Generator Sets—NEW

TURBO-GENERATORS

WE ALWAYS CARRY A VERY LARGE STOCK OF TURBO-GENERATORS

A Few Stock Machines are Noted Below

5000-KVA. G.E. 200#, 100-Deg., 2300-V.
3750-KVA. G.E. 200#, 2300-V., Condensing
3125-KVA. G.E. Cond., 200#, 2300/4000-V.
2500-KVA. West., 200#, 2300-V., (1-GE.)
1865-KVA. G.E., Cond., 200#, 2300-V.
1250-KVA. Allis-C. Non-Cond. 160#, 25-Back, 2300/
937-KVA. Allis-Chalmers Cond., 220#, 480-V.
625-KVA. West., Aut. Extr., 250#, 25#-Back, 480-V.
625-KVA. G.E., Non-Cond., 200#, 25#-Back, 2300-V.
500-KW., Several Good Units Available

We Can Furnish Almost Any Capacity-Type Machine Wanted. Send Us Your Spec., Giving Steam Pressure and Voltage

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Tremendous Savings Possible

NEW CONDENSERS IN STOCK—Latest Models

11—100-sq. ft.; 8—580, 3—581 and 2—585 sq. ft.; Also 3—2200, 3—3300, 1—8280 and 1—8400-sq. ft. All NEW: Modern Laning NEW Circulating Water Pumps, Condensates, Evactors Made Specially for our New Condensers

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Mechanical-Electrical Engineers

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LIQUIDATION SALE—Modern Equipment

DIESEL ENGINES

	Make	Model	H.P.	R.P.M.	Cycle	Cylinders	Bore & Stroke	Year	Reverse & Reduction Gear
4	General Motors	16-258S	1800	900	4	16	9½" × 12"	1943	2.41:1 (fluid coupling)
2	Hamilton	R.B.99-D.A.	1600	700	2	9	9 1/16" × 13⅜"	1944	
	General Motors	12-278A	1200	750	2	12	8¾" × 10½"	1944	Falk 2.5:1
35	General Motors	12-567ATL	900	744	2	12	8½" × 10"	1942-44	Falk 2.5:1
2	General Motors	8-268A	500	1200	2	8	6½" × 7"	1943	2.54:1
2	Fairbanks Morse	38 O/P	300	1200	2	6	5" × 6"	1936	
4	Buda	6LD468	95	1850	4	6	4¼" × 5½"		

Ask For Our Complete 1948 CATALOG

A. C. DIESEL GENERATOR SETS

								KW	Volts	Cycles	Phase	Make of Generator	DC Generator KW	DC Generator Volt
3	General Motors	8-268A	350	1200	2	8	6½" × 7"	1943	200	440	60	3	Westinghouse	40	120/240
1	General Motors	3-268A	150	1200	2	3	6½" × 7"	1943	100	440	60	3	Century	2	120
1	Fairbanks Morse	3 A	110	1200	4	8	5½" × 7½"	1936	80	450	60	3	Fairbanks Morse	3	120

D. C. DIESEL GENERATOR SETS

7	General Motors	16-278A	1600	750	2	16	8¾" × 10½"	1943	1200	525 DC	Allis Chalmers Type MHC 2290 AMPS
2	General Motors	8-268A	500	1200	2	8	6½" × 7"	1944	375	120/180/240 DC	Westinghouse
50	Superior	GDB-8	150	1200	4	8	5½" × 7"	1942-44	100	120/240 DC	Delco Model T362 3 wire stab. shunt 60° C rise 417 AMPS
2	General Motors	3-268A	150	1200	2	3	6½" × 7"	1943-44	100	120/240 DC	Allis Chalmers
1	Fairbanks Morse	36A5½DE	100	1000	4	6	5½" × 7½"	1943	60	225 DC	F.M. Type DGZH compd. wd. 267 AMPS
1	Caterpillar	D3400	26	1500	4	4	3¾" × 5"	1942	15	120/240 DC	General Electric Model 52A1990 compd. wd.

BOILERS

6—Express Boilers, modified D type, Foster Wheeler 30,000# steam/hr., 435# press., with economizers, superheaters, desuperheaters, oil burners, etc.

2—Boilers, single pass., header-type, Babcock & Wilcox, built 1941, 22500# steam/hr., at 250# press.

2—Wickes Boilers 628 H.P. 3 drum, 250 pounds pressure.

8—B&W, D type, 580# press., 5400 sq. ft. heating surface.

1—B&W, stationary boiler, 40,000# steam per hour 1000-1500# press. (complete installation, unusued).

6—Cyclotherm 3000 pounds steam per hour, 125# press.

10—Cleaver-Brooks, 2000# steam pr. hr. 35# press.

TURBO-GENERATORS

6—300 KW G.E. type ATI 3/60/450, 1200 RPM cond., compl. with 40 KW exciters, condensers, switchboards.

2—200 KW Westinghouse, 3/60/450, 1200 RPM cond. (NEW).

8—200 KW, G.E. type ATB 3/60/450, 1200 RPM, cond. and non-cond.

2—132 KW G.E. type ATB 3/60/450, 1200 RPM, cond.

2—375 KW West'hse 180/240 V, DC, 3000 Amp, 1200 RPM, cond.

12—150 KW West'hse type SK, 120 V, DC, 1200 RPM, cond.

20—60 KW West'hse type SK, 120 V, DC, 1800 RPM cond.

NOTE—MANY GENERATORS FOR SALE SEPARATELY WITHOUT TURBINES

CONDENSERS—(New)

1—9533 sq. ft. ¾" brass tubes

10—3800 sq. ft. ⅝" copper nickel tubes

2—1050 sq. ft. 940 tubes

DISTILLING PLANTS

2—40,000 gallons per day, Foster Wheeler triple effect low pressure

1—80 tons per day, Condenser Service, double effect

4—8000 gals. per day Griscom Russell Soloshell double effect complete with pumps

3—5000 gals. per day, Cleaver Brooks self contained units complete with pumps and fans

10—2000 gals. per day Kleinschmidt vapor compression distiller mfd. by Badger.

1—750 gals. per day, same as above.

MOTORS

G.E., 6000 HP 3/93⅓/2700 V 400 RPM or 3800 HP 3/60/1700 V 257 RPM.

HOISTS

10—Main drum 100,000# pull at 10 FPM to 3000# pull at 400 FPM, 2 Gypsies 12,000# pull at 125 FPM, driven by 50 HP 230v. D.C. motors 525—1800 RPM.

15—Main drum 15,000# pull at 78 FPM, 3360# pull at 348 FPM and 2 auxiliary drums. Driven by Chrysler 28.35 H.P. gasoline engines. (NEW).

AIR COMPRESSOR

1—8000 CFM, dischgr press. 100# Ingersoll-Rand turbine driven.

MOTORS

1500 HP 525 V DC 600 RPM W'hse

GENERATORS

1200 KW 525 V DC 750 RPM All. Chalm.
1122 KW 400 V DC 720 RPM Elliott
1075 KW 375 V DC 750 RPM Elliott

Note: These motors and generators suitable for operation at lower voltage.

HYDRAULIC PUMPS

5—Vertical, quintuplex, 4⅝ x 10, 450 gpm at 128 RPM against 2500 p. s. i., mfg. by Aldrich, driven by 700 HP synchr. motors 3/60/2300.

TRANSFORMERS

10—50 KVA
10—25 KVA
10—20 KVA
10—15 KVA
} from 400 V to 120 V, all single phase, 60 cycle, dry type

REDUCTION GEARS

4—1800 HP 2.41:1 10—20 HP 41:1
10— 900 HP 2.48 10—11 HP 39:1
10— 25 HP 20:1 10—10 HP 1750:63

7—Waterbury hydr, type K, size 35, 5 and 2A

MISCELLANEOUS

MOTORS	AC 400 V and 2200 V	From 5 HP to 350 HP.
MOTORS	DC 115, 230 and 525 V	From 3 HP to 1500 HP.
MOTOR-GENERATORS	AC:DC and DC:AC	From 3 KW to 60 KW.
PUMPS	Up to 15000 GPM	Up to 725# press.
CENTRIFUGES	Sharples and DeLaval	100 GPH and 150 GPH.
TURBO-BLOWERS	15600/20000 CFM	From 17" S.P. to 18.5" S.P.
FANS	AC and DC motor drive	From 2000 CFM to 15000 CFM.
AIR COMPRESSOR	High pressure	From 700# to 3000# press.
FEED WATER HEATERS	High and low press.	Up to 263 sq. ft.
ICE PLANTS	Motor and steam driven	From ½ ton to 22 tons.
CONDENSER TUBES	(NEW) Cupro Nickel	⅝" OD, 18 gauge.
BLAST CABINETS	Pangborne	For Sandblasting.
WIRE ROPE SLINGS	Various sizes	Large quantities

7—BLOWERS (Roots Connersville) size 16" x 18", connected to G.E. induction motors 200 H.P., 3 phase 60 cycle, 2200 Volt, 705 RPM
2—BLOWERS (Roots Connersville) size 20" x 23" connected to Westinghouse Electric induction motor 350 H.P., 3 phase 60 cycle, 2200 Volt, 590 RPM
(Blower Motors also sold separately.)

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CHECK √ THIS LIST OF GOOD USED AND NEW EQUIPMENT √ READY FOR YOU *NOW*

BOILERS—PORTABLE
1— 60 HP Erie City Econ., 100#
1—100 HP Erie City Econ., 100#
1—102 HP Ames Empire, 125#
2—107 HP Kewanee, 125#
1—150 HP Erie City Econ., 150#
2—250 HP Kewanee, Ser. 500, 125#

BOILER—SCOTCH
1— 75 HP O & S Scotch, 100#
2—100 HP Hodge, 125#
1—125 HP Leffel Scotch, 125#
2—130 HP Hodge, NEW, 140#
1—300 HP Titusville, NEW, 125#

BOILERS—LOCOMOTIVE
1— 90 HP Fitzgibbons, 100#
1—100 HP Farrar & Tr., 300#
2—125 HP Oil Well, 300#

BOILERS—H.R.T.
1—125 HP Titusville, 125#
2—165 HP Bigelow, 125#
4—200 HP Portland, 125#

BOILERS—WATERTUBE
1—250 HP Heine, 150#
1—253 HP B&W Stirling, 180#
2—300 HP Oil City, 160#
1—300 HP Wickes, NEW, 200#
1—304 HP Heine, 175#
1—330 HP Badenhausen, 200#
2—400 HP Heine, 200#
1—400 HP Walsh-Wid., 300#
2—400 HP B&W Stirling, 425#
1—434 HP Heine, 200#
1—498 HP B&W Stirling, 160#
1—508 HP B&W Sec. Header, 200#

DIESEL GENERATORS—A.C.
1—1000-KW G.M.-Wsthgse 2300-V.
1— 800-KW Hamilton-Wsthgse 2300-V NEW
1— 290-KW G.M.-Wsthgse 250-V.
1— 250-KW Busch-Sulzer-G.E. 2300-V.
1— 200-KW Fairbanks-Morse 440-V.
2— 200-KW G.M.-Wsthgse 440-V.
1— 100-KW G.M.-Westhgse 220-V.
1— 100-KW G.M. Wsthgse 440-V.
1— 75-KW Cat.-G.E. 127/220-V.
2— 70-KW Coop-Bess.-G.E. 450-V.
1— 60-KW G.M.-G.E. 127/220-V.
1— 50-KW Cat.-Elect. Mach. 120/208-V.
1— 50-KW Murphey-Elect. Mach. 120/208-V.
2— 30-KW Cat.-G.E. 240-V.
1— 30-KW International 230/400-V. NEW.
1— 29-KW International 230/400-V. NEW.
1— 15-KW International 120/208-V. NEW.
1— 12-KW International 120/208-V. NEW.
1— 10-KW International 230/400-V. NEW.
1— 5-KW Palmer 120/230-V. NEW.

TURBOGENERATORS—A.C.
1—6000-KW G.E. Cond 2300-V.
2—4000-KW G.E. Cond 2300-V.
1—4000-KW Wsthgse Cond 2300-V.
1—3500-KW G.E. Cond 2300-V.
2—3000-KW G.E. Cond 2300-V.
1—2500-KW Wsthgse Cond 2400-V.
2—2500-KW Wsthgse Cond 2300-V.
1—2000-KW All Chal. Cond 480-V.
1—2000-KW G.E. Cond 2300-V.
2—1500-KW G.E. Cond 6600-V.
4—1500-KW Elliot Cond 2300-V.
4—1500-KW G.E. Cond 2300-V.
1—1400-KW All. Chal. Cond 2300-V.
5—1250-KW G.E. Cond 2300-V.
2—1250-KW All. Chal. Cond 2300-V.
2—1250-KW G.E. Non-Cond 2300-V.
1—1000-KW All. Chal. Cond 480-V.
1—1000-KW Wstghse Non-Cond 2400-V.
2—1000-KW DeLaval Non-Cond 4150-V.
2—1000-KW Wsthgse. Cond. 2300-V.
1—1000-KW DeLaval Cond. 4150-V.
2—1000-KW G.E. Cond. 2300-V.
2—1000-KW All. Chal. Non-Cond 2300-V.
1—.750-KW All. Chal. Non-Cond 480-V.
1— 750-KW Terry Non Cond 440-V.
1— 750-KW G.E. Cond 480-V.
1— 750-KW All. Chal. Cond 480-V.
2— 600-KW G.E. Cond 440-V.
1— 500-KW Wsthgse Non-Cond 480-V.
1— 500-KW G.E. Non-Cond 2300-V.
1— 250-KW G.E. Cond 450-V.
3— 250-KW Wsthgse Cond 450-V.
1— 200-KW Wsthgse Cond 450-V.

ENGINE GENERATORS—A.C.
1—285-KW Chause-Cr. Wheel. 240-V.
2—250-KW Skinner-All. Chal. 2300-V.
2—200-KW Skinner-G.E. 2300-V.
1—200-KW Ames-Cr. Wheel. 480-V.
1—200-KW Skinner-G.E. 480-V.
1—200-KW Ames-Burke 250-V.
1—160-KW Ames-Cr. Wheel. 240-V.
1—150-KW Ames-G.E. 440-V.
1—100-KW Ball-Wsthgse 240/480-V.

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60,000# Steam per hr. 475# Working Pressure

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55,000# Steam per hr. 250# Working Pressure

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Package type with Feed pump 100# Designed Pressure

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Reciprocating Pumps Duplex *(Vertical & Horizontal)*
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SHIP BREAKERS

DIESEL ENGINES

GENERAL MOTORS 900 H.P. 12-567, 2 cyc. 12 cyl. 8½"x10", 744 RPM. with Falk reversing and reduction gear. Ratio 2½ to 1. Electric Starting. Auxiliaries Available.

DIESEL GENERATORS

100 KW D.C. GENERATORS, 240-120V. 417 amps. 1200 rpm. Driven by Superior Diesel 150 H.P. Model GDB-8, 8 cyl. 5½"x7". Electric Starting. Auxiliaries Available.

TURBO-GENERATORS

Turbo-Generator	Generator	Exciter	Reduction Gear	Turbine
300 KW A.C. General Electric	340 KW. 450 V. 3 Phase 60 cyc. 481 amps. 1800 rpm.	D.C. 40 KW. Stab. Shunt Wound Type MPL166Y Form ES 330 amps. 120 V. Full Load.	Ratio 4.061	400# W. P. 3 Stage Condensing
200 KW. A.C. General Electric	450 V. 3 Phase 60 cyc. 200 KW 1200 rpm.	D.C. 5 KW. Comp. Wound Type EF1 Form E8, 41.6 amps.	Ratio 8.393	375# W. P.
132 KW. A.C. General Electric	450 V. 3 Phase 60 cyc. 1200 rpm. 257 amps. 132 KW.	D.C. 120 V. 22.6 amp. 40 KW.	Ratio 8.393	618# W. P. 5 Stage Condensing
132 KW. A.C. General Electric	132/45 KW. 230/120 V. 3 Phase 60 cyc. 439/288 amps. 1200 rpm.	30 KW. 120 V. 260 amps. Type B-4 Form C.	Ratio 8.393	360# W. P. 10071 rpm.
60 KW. D.C. Westinghouse	120 V. 500 amps. 1800 rpm.		Ratio 4.047	200# W. P. 7283 rpm.
50 KW. D.C. General Electric	50 KW 115V/125V 3000 rpm.			250# W. P. Non-Condensing

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SPECIAL—500 KW M-G SET

Allis Chalmers 725 HP synch. motor 3/60/2300 V. on base coupled to 500 KW gen. DC 250 V 900 RPM with AC & DC panels. NEW in 1943, A-1 condition now.

M-G SETS

KW	Mfr.	Input V	Output V
500	Allis Ch.*	2300 AC	250 DC
300	Gen. Elec.*	220/440 AC	230 DC
200	Gen. Elec.*	2200 AC	125 DC
150	Ridgeway*	2300 AC	250 DC
150	Gen. Elec.	220/440 AC	125 DC
105	Century b.b.	220/440 AC	70 DC
50	Cr. Wheeler	220/440 AC	250 DC
40	El. Prod.	220/440 AC	125 DC
37½	Whse.	230 DC	3 ph. 240 AC
35	Gen. Elec.	220/440 AC	48 DC
30	Marble Card	220/440 AC	60 DC
30	Elec. Prod.*	220/440 AC	50 DC
25	G.E. NEW	220/440 AC	125 DC
9	H.V.W. 1500 amp.	220/440 AC	6/12 DC

*Synch. motor drive.

D. C. MOTORS

H.P.	Mfr.	Type	Volts	Speed
100/150	G.E. dynamom.	TLC	25	1000/3500
80/125	Gen. Elec.	C100	230	500/1000
75	Whse.	S13L	115	575
75	Gen. Elec.	BRC	115	1150
65	Gen. Elec.	C	230	375/750
60	Diehl dynamom.	R10	250	500/2000
50	Cr. Wheeler	50H	230	700
50	Gen. Elec.	CL	230	600
40	Whse.	SK	230	750
40	Reliance	310T	230	625/1200
40	Gen. Elec.	RC31	230	1750
35/50	Gen. Elec.	CD123	230	575/1150
30	Whse.	S-7	115	900
25	Sprague dyna.	LC	230	750/2000
25	Chand'son (4)	C13	115	850
25	Roth	RS	230	1750
25	G.E. bb NEW	CDM93	115	1150
20	Gen. Elec. (2)	RC29	230	1750
20	G.E. bb NEW	CDM83	115	1750
20	Gen. Elec.	RC11	115	1150
20	Reliance	T	230	850
20	Gen. Elec.	LC	230	575
20	Gen. Elec.	DLC	230	500/1500
15	Gen. Elec.	RC	115	1150
15	Roth	85RS	230	1750
15	G.E. bb NEW (2)	CDM67	115	1750
15	Gen. Elec.	RC10	230	1150
15	Whse. (5)	SK90	230	825
15	Gen. Elec.	CD95	230	550/1650

D. C. GENERATORS

KW	Mfr.	Type	Volts	Speed
300	G.E. 1 brg.	MPC	125/170	1150
105	Century b.b.	1500a	70	1200
100	G.E.	TLC	250	1150
80	G.E	C100	250	600
75	Whse.	S	125	600
50	Gen. Elec.	CL	250	750
50	Cr. Wheeler	CCD	250	850
24	Whse.	SK	600	850
25	G.E. NEW b.b.	CD93	125	1450
20	Allis Ch.		125	475
12	Engberg b.b.	MR	250	1150
15	Gen. Elec.	RC	125	1200

EXPLOSION PROOF MOTORS—NEW

2—3 HP 1200 RPM
2—7½ HP 1800 RPM
1—7½ HP 900 RPM
2—3 HP 1800 RPM
3—5 HP 1800 RPM
1—10 HP 900 RPM
1—15 HP 1800 RPM
2—20 HP 1800 RPM
1—10 HP 1800 RPM

A. C. GENERATORS

KVA	Mfr.	Type	Volts	Speed
625	Gen. Elec.	ATB	2300	450
500	Allis Ch.	3 brg.	240/480	360
250	Whse.	G	2300	600
156	G.E. 1 brg.	ATB7558	240/480	1200
150	Allis Ch.	B	240/480	720
100	Cr. Wheeler		2300	900
75	Triumph	A15L	240/480	900
60	El. Machy.		240/480	900
56	Gen. Elec.	ATB	240/480	1200
50	Cont. b.b.	S107	120/208	1200
25	Whse. b.b. (3)	1 phase	120	900
12½	Whse. b.b. NEW		240	1200

A. C. MOTORS—SLIP RING

3 Phase 60 Cycle 220 or 440 Volts

Qu.	H.P.	Mfr.	Type	Speed
1—	400	G.E. 3 brg.	I-P	450
1—	300	G.E. 2200 V.	I-M	1800
1—	300	Gen. Elec.	MT365	1200
1—	200	Gen. Elec.	IM-E13B	1800
1—	200	Whse. 3 brg.	HF	600
1—	200	G.E. 2200V.	IM-15A	720
2—	150	G.E. int.	ITC5015	720
1—	150	Gen. Elec.	IM-16	600
1—	100	Al. Ch. b.b. NEW	ARY	600
1—	100	Whse.	CW	720
1—	100	Whse.	CW761C	1800
2—	100	Gen. Elec.	IM-15	720
1—	75	G.E. 2200V.	I-M	720
1—	75	Gen. Elec.	IM-14	600
1—	75	Gen. Elec.	MT337	1800
1—	50	Fair. Morse	BV	720
1—	50	Gen. Elec. int.	ITC	600
1—	50	Whse. int.	CI	600
2—	40	Gen. Elec.	MT336	900
1—	40	Allis Ch.	ANY	450
1—	37	G.E. int.	ITC	600
1—	35	Lancashire	b.b.	1800
1—	30	Gen. Elec.	OMT336	1200
1—	30	Gen. Elec.	MT346	600
2—	25	Gen. Elec.	I-M	1200
1—	25	Triumph	SR	1200
1—	25	Gen. Elec.	I-M	600
1—	20	P & H b.b. int.	WT8	1200
1—	15	Watson	KHV	720
1—	15	P & H b.b. int.	W7	1200

A. C. MOTORS—25 CYCLE

H.P.	Mfr.	Type	Volts	Speed
150	Whse.	C	440	500
150	Whse.	HF	440	500
50	G.E. int.	MTC5337	440	750
50	Allis Ch.	ANY	440	1500
25	Howell	SR	440	750

1000 NEW MOTORS IN STOCK

A.C. 1 ph. & 3 ph.—Fract. H.P. up to 60 H.P.—All speeds, open & enclosed—standard makes—quantity discount.

A. C. MOTORS—SYNCHRONOUS

H.P.	Mfr.	Type	Volts	Speed
667	Gen. Elec.	ATI	2200	450
300	Whse.	G	2200/440	600
275	Whse.	G	2200	900
200	G.E. 25 cycle	ATI	220/440	500
150	Gen. Elec.	ATI	220/440	600
125	G.E. splprf.	TS955	220/440	1200
100	American b.b.	YGH	220/440	900
75	E. Prod. b.b.	.8PF	2200	1200
75	El Machy.	BRKT	550	900
60	Gen. Elec.	ATI	220/440	1200

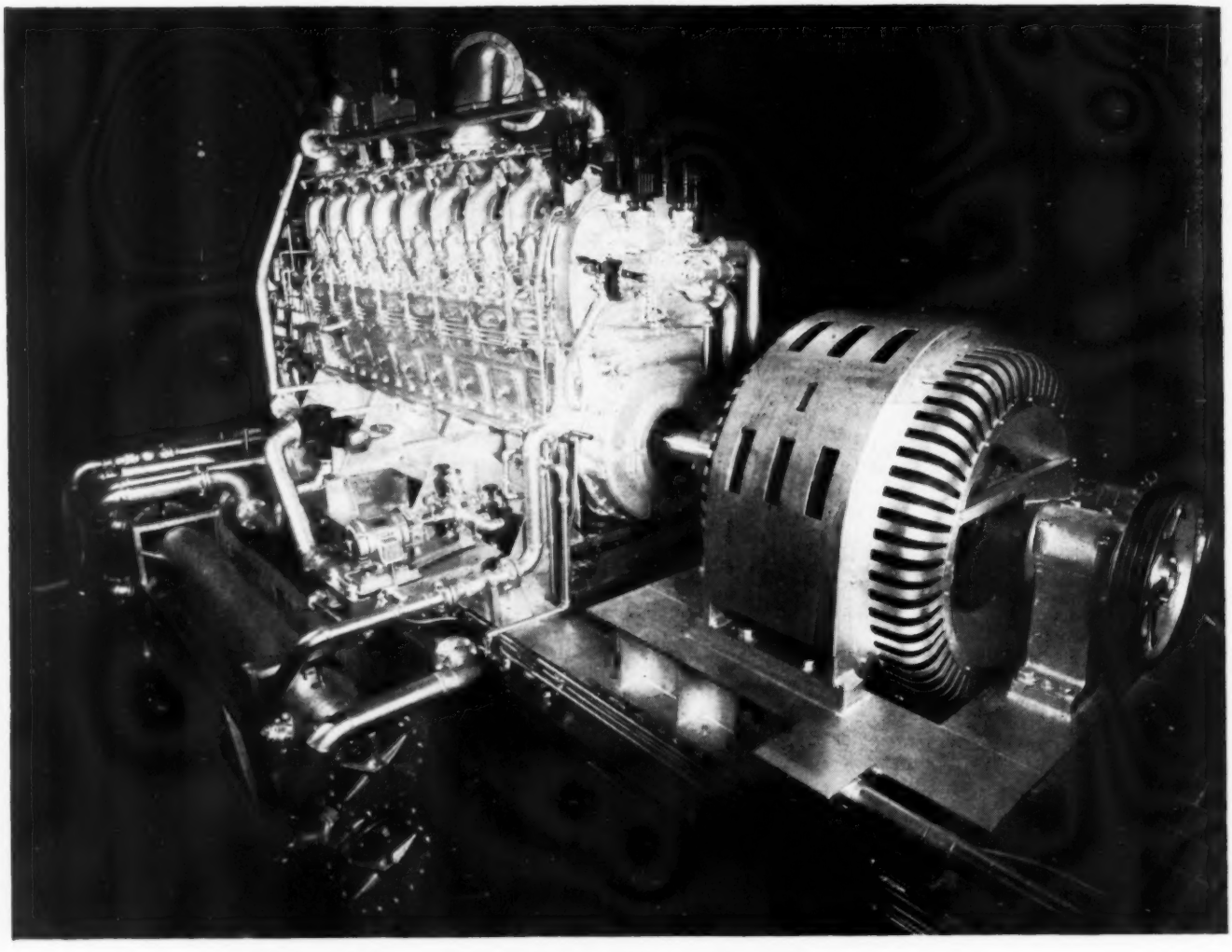
A. C. MOTORS—SQUIRREL CAGE

3 Phase 60 Cycle 220 or 440 Volts

Qu.	H.P.	Mfr.	Type	Speed
1—	250	G.E. 2200V.	I-K	600
1—	200	G.E. 2200V.	KTP559	1200
1—	150	Allis Ch. b.b	AR	720
1—	150	Reliance b.b. encl.	AA	900
2—	150	Fair. Morse	B	600
2—	125	Allis Ch. b.b.	AR	450
1—	125	Cont. 2200V. b b.	SC	1800
1—	100	GE. b.b. NEW	K 504S	1800
1—	100	Whse. vertical	CS	1200
1—	75	Gen. Elec.	KT329Y	3600
1—	75	Gen. Elec.	KT352	900
1—	75	Gen. Elec.	I-K	720
1—	60	Allis Ch. 4000/2200V.	AR623	1800
2—	60	Gen. Elec.	K505	1200
1—	60	Gen. Elec.	I-K	600
1—	60	Whse. b.b. NEW	CS444S	1800
2—	60	Gen. Elec.	KT552	720
1—	50	GE. TEFC b.b.	KF445	3600
1—	50	Whse. b.b. NEW	CS405S	1800
2—	50	Gen. Elec.	KT552	600
1—	50	GE. 2 phase	I-Q	900
2—	50	G.E. NEW b.b. HT	KG405	1800
1—	50	G.E. NEW hitorq	KG445	1200
2—	50	Gen. Elec.	K505	900
1—	50	Gen. Elec.	KT342	900
2—	50	Whse. vertical	CS766	900
1—	40	G.E. NEW	K404	1800
1—	40	Howell b.b.	SC	1800
1—	40	Al. Ch. 3 speed	ARX 900/600/450	
1—	40	Gen. Elec.	I-K	1200
6—	40	Gen. Elec.	KT336	900
2—	35	Gen. Elec.	I-K	720
2—	35	Gen. Elec.	I-K	900
2—	30	Howell b.b. 4 spd.	SC	1800
2—	30	G.E. NEW b.b.	K365	1800
2—	30	G.E. NEW hitorq	KG365	1800
2—	30	Whse. NEW b.b.	CS405	1200
2—	30	G.E. TEFC b.b.	K404	1800
1—	30	Gen. Elec.	I-K	900
1—	30	Gen. Elec.	KT336	720
1—	30	Wagner	22T8P	900
1—	30	Whse. TEFC b.b.	CS405	1800
1—	30	Whse.	CS646	900
1—	25	Diehl NEW b.b.	IN404	1200
2—	25	Whse. NEW spl. b.b.	CS365	1800
1—	25	Allis Ch.	AN	1800
1—	25	Gen. Elec.	IK	1200
1—	25	Allis Ch.	AN	1200
1—	25	Gen. Elec.	KT526	900
4—	25	Whse.	CS646	900
2—	25	Gen. Elec.	I-K	600
1—	20	G.E. TEFC b.b.	K404	1200
2—	20	U.S. NEW b.b.	SC326	3600
1—	20	Gen. Elec.	KT182	3600
1—	20	G.E. NEW hitorq	KG364	1800
2—	20	G.E. NEW b.b.	K364	1800
2—	20	Delco NEW TEFC	C364	1800
3—	20	Whse. NEW b.b. spl.	CS364	1800
2—	20	Gen. Elec.	KT312	1200
2—	20	Gen. Elec.	I-K	1200
1—	20	Whse.	CS	1200
1—	20	Gen. Elec. b.b.	I-K	900
1—	20	Fair. Morse	BH	900
2—	20	G.E. NEW b.b.	K365	1200
2—	20	Diehl TEFC NEW	INF364	1800
2—	20	Century b.b. 4 speed	SC504	1800
2—	15	Whse. TEFC NEW	CS365	1200
4—	15	G.E.NEW b.b.	K324	3600
2—	15	Whse. NEW b.b.	CS326	1800
2—	15	Diehl NEW b.b.	D1326	1800
2—	15	Whse. NEW TEFC	CS326	1800
2—	15	Whse. NEW b.b.	CS364	1200
1—	15	Diehl TEFC NEW	INF 365	1200
2—	15	Gen. Elec.	KT954	1800
2—	15	G.E. spl. b.b.	K365	1200
4—	15	Gen. Elec.	KT302	1200
1—	15	Gen. Elec.	KT512	900
1—	15	L. Allis	OX365	900

ARTHUR WAGNER COMPANY

1436-38 W. RANDOLPH STREET — CHICAGO 7, ILL. — MONroe 7409



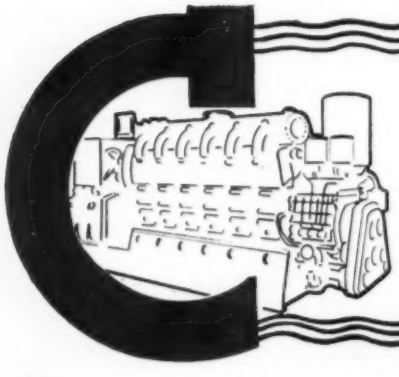
DIESEL ENGINE SETS . . . . .

1600 H.P. General Motors, model 16-278-A, 16 cylinder Diesel Engine, bore 8¾", stroke 10½", R.P.M.—720—direct connected to—New 1250 K.V.A. Ideal Electric & Manufacturing Co Generator, 2400 volts, 3 phase, 60 cycle A.C. @ .8 p.f. Belted exciter—New 10 K.W. Ideal Elec. & Mfg. Co.

The illustration above shows an actual installation of the set described, for a midwestern utility. This set, Cusac engineered from start to finish has proven completely satisfactory. Since this picture was taken another identical, Cusac engineered generator set has been installed adjoining it. These two sets, in operation now, can be seen by appointment. Similar installations can be made in the next six months from units now in our inventory.

1000 H. P. General Motors, model 12-567-A, 12 cylinder Diesel Engine, bore 8¾", stroke 10½", R.P.M.—720—direct connected to New 900 K.V.A. Ideal Electric & Manufacturing Co. Generator, 2400 volts, 3 phase, 60 cycle A.C. @ .8 p.f. Belted exciter—New 10 K.W. Ideal Elec. & Mfg. Co.

"Cusac engineered", means a complete, competent, dependable engineering service—from purchase of equipment to final installation and approval. Our reputation is based on performance—not promises. Our installations carry a new machine guarantee backed with a performance bond.



F. L. CUSAC *and Associates*

DIESELS

Wabash 5860

BOARD of TRADE BLDG. — — CHICAGO

COMPLETE LIQUIDATION

Save 30 to 40%!

BRAND NEW ELECTRIC MOTORS

Surplus Stock MUST Be Sold—Immediately

EVERY MOTOR CARRIES ORIGINAL MANUFACTURERS GUARANTEE OF 1 YEAR

SQUIRREL CAGE

3 Phase, 60 Cycle, 220/440 Volts—Ball Bearing 40° C Rise

Continuous Duty—Dripproff Construction—

Qu.	HP	Make	Speed	Low Net Price Each
9	1	Century T. E.	1800	$58.50
30	1	Century	1800	45.00
22	1	Cleveland	1800	37.00
10	1	Century	3600	49.00
2	1½	Cleveland	1800	43.00
6	1½	Century	1800	53.00
30	1½	Century	1200	61.00
5	2	Century	1800	61.00
11	2	Brown Brockmeyer	1800	50.00
5	2	Sturtevant T. E.	1800	75.00
25	2	Century	1200	68.00
35	3	Brown Brockmeyer	1800	55.00
29	3	Century	1800	68.00
18	3	Westinghouse	1200	81.00
9	3	Century	1200	81.00
32	5	Century	1800	81.00
17	5	Cleveland	1800	66.00
4	5	Brown Brockmeyer	1800	65.00
15	5	Century	1200	106.00
4	5	G. E. Splpr.	3600	96.00
31	7½	Cleveland	1800	86.00
26	7½	Century	1800	106.00
4	10	Century	1800	135.00
8	10	Westinghouse	1200	161.00
15	10	Century	1200	161.00
6	15	Cleveland	1800	131.00

NEW SINGLE PHASE,

60 Cycle, 115/230 Volts 40° Continuous Capacitor Start

30	½	Century S. B. Cush. Base	1800	32.50
80	¾	Century S. B.	1800	41.50

ADVISE REQUIREMENTS — ***Partial Listing Only*** — MANY OTHERS IN STOCK

TERMS: ⅓ Deposit With Order, Balance Sight Draft B/L. Attached. Or Purchase Order of Satisfactorily Rated Companys.

ALL MOTORS SUBJECT TO PRIOR SALE

PENN LIQUIDATING CO.

Established 1928

115 N. 3rd St., PHILADELPHIA 6, PA., MArket 7-4191

QUALITY REBUILDING BY SKILLED CRAFTSMEN

MOTOR GENERATOR SETS

KW	Make	A. C.	D. C.
1000	G.E.	4000/2530	600
800	Whse.	13200	250
500	G.E.	6600	250
350	G.E.	440	250
150	G.E.	2300	275
90	G.E.	2300	110
75	G.E.	2300	125
75	El. Pdts.	220	125
70	G.E.	440	125
65	G.E.	440	125
60	Al. Ch.	2300	110
40	Bogue	220/440	125/250
40	G.E.	220/440	125
35	G.E.	220	40
30	G.E.	220/440	230
25	Watten	220	97/111

SQUIRREL CAGE MOTORS

HP	Make	Type	Volts	Speed
800	Whse.	CS	2200	706
500	Elliott		2300	720
500	G.E.	IK	440	1200
350	Lincoln		440	900
300	Whse.	CS	440	400
250	Whse.	CS	440	1200
200	Whse.	CS	440	900
200	Al. Ch.	AR	2200	900
150	G.E.	K	440	1800
125	G.E.	TEFC	440	1180
125	Al. Ch.		440	435
125	Howell	CS	2200	1200
100	Al. Ch.	AR	440	495
100	Century	SC	440	1800
75	Al. Ch.	AR	2200	1765
60	G.E.	K	440	1800
60	Al. Ch.	AR	440	495
50	Al. Ch.	AR	440	1800
50	G.E.	IK	440	900

SLIPRING MOTORS

HP	Make	Type	Volts	Speed
1000	Whse.	HR	2300	360
750	Whse.	CW	2300	440
600	G.E.	I	6600	300
600	G.E.	M	440	1775
435	G.E.	I	4000	1180
400	Al. Ch.	NO	440	600
350	G.E.	IM	440	720
300	Al. Ch.		2300	505
300	G.E.	IM	440	720
300	G.E.	I	440	1800
250	Whse.	CW	2200/400	345
250	Whse.	CW	2200	580
200	Cr. Wh.		220	600
175	Ideal		440	585
150	G.E.	IM	2200	1800
100	G.E.	IM	440	720
50	Louis Als.	GH	440	870

SYNCHRONOUS MOTORS

HP	Make	Type	Volts	Speed
2100	G.E.	ATI	4600	514
900	Al. Ch.	AL	2300	150
600	G.E.	TS	4160	1200
500	Whse.		2300	514
450	El. Ma.	BRG	440	240
430	G.E.	ATI	2200	720
400	G.E.	TS	440	600
300	G.E.	TRC	440	240
300	E. M.		440	900
250	G.E.	TS	2300	600
60	G.E.	TS	220	1200

GEARHEAD MOTORS

HP	Make	Type	Volts	Speed
5	G.E.	K	220/440	98.9
3	Sterling	KFA	220/440	350
3	G E	KT	440	488
2	Sterling	KFA	220/440	230
2	Sterling	KFB	220/440	59
2	U. S. El.	GH	220/440	230
1½	G.E.	K	220/440	230
1½	G.E.	K	220/440	37
1½	Sterling	KFB	220/440	88
1	U. S. El.	GH	220/440	350
1	U. S. El.	GS	220/440	190

D.C. MOTORS

HP	Make	Type	Volts	Speed
430	G.E.	MPC	250	950
300	G.E.	MP	250	425
100	G.E.	RC	220	2500
60	G.E.	CD	550	1000
45	Whse.	S	250	650
40	Cr. Wh.	CCM	230	575
40	G.E.	E	220	620
35	Cr. Wh.	CM	220	840
35	N. W.		230	1275
30	Cr. Wh.	CCM	220	450
30	Al. Ch.	Bullock	230	575
27½	G.E.	CL	220	745
25	Whse.	S	220	850
25	N. W.	K	230	900
25	G.E.	CL	220	725
25	Marble	Card.	220	1800
20	Cr. Wh.	CM	230	775
20	Al. Ch.	E	230	1150
20	White	SK	230	975
15	G.E.	CVC	230	925
15	Cr. Wh.	CM	230	800
15	G.E.	RC	230	1150
13	L. A.	NA	230	600
10	G.E.	CD	230	1150

A.C. GENERATORS

Kva	Make	Type	Volts	Speed
2500	G.E.		480	3600
1625	Whse.	ES	2300	240
938	Whse.		2200	720
450	Al. Ch.		440	360
225	G.E.	TS	440	600
175	Al. Ch.		480	600

CHICAGO ELECTRIC CO.

1320 CERMAK ROAD — CHICAGO 8, ILL. — CANAL 2900

NEW AC MOTORS

3/60/220/440 VOLTS

Quan.	HP	Speed	Remarks
3	½	1200	220 V.-T.E.
1	½	1200	T.E.
1	½	1800	T.E.N.V.
3	1	1200	T.E.
1	1	1200	X.P.
1	1	1800	220 V.-X.P.
2	1½	1200	T.E.
1	1½	1200	T.E. w/Brake
1	1½	1800	T.E.
1	1½	1800	X.P.
2	1½	3600	T.E.
6	2	1200	T.E.F.C.
1	2	1800	X.P.
1	2	1800	Open
1	2	3600	T.E.
2	2	3600	T.E.F.C.
1	3	1200	X.P.
1	3	1200	208 V.-X.P.
2	3	1800	T.E.F.C.
3	3	3600	T.E.F.C.
1	5	1200	X.P.
6	5	1200	T.E.F.C.
1	7½	1200	T.E.F.C.
1	7½	1200	X.P.

1/60/110/220 VOLTS

7	1	1200	T.E.
3	1½	1800	X.P.
1	2	1200	Open
1	3	1800	Open

NEW GEAR MOTORS

3/60/220/440 VOLTS

Quan.	HP	Output RPM	Remarks
1	½	96	440 V.-Open
1	½	72	Open (1/60/110 Volts)
1	½	72	440 V.-Open
1	½	86.2	Open
1	½	290	Open
1	1	37	Open
1	1	45	Open
1	2	98.9	Open

MOTORS

1—125 H.P. West. Squirrel Cage, 3/60/2200 volt, 1800 RPM and Starter.

1—20 H.P. General Electric Induction Motor, 3/60/220 v., 1160 RPM.

2—Vertical Gear Head Motors, Crocker Wheeler, TEFC 10 H.P., 220/440 volt, 60 cycles, 3 phase, 1745 RPM. Philadelphia Gear, output 425 RPM.

1—10 H.P. Sterling Type KRE enclosed Speed-trol motor 3/60/220/440 volt, 1350/900 RPM.

AIR CONDITIONING UNITS

1—Frigidaire Compressor Model FE 102, nominal capacity 20 tons with EC-202 Evaporative Condenser, #3052-F3 and #3052-4 Freon cooling coils. Powered by 20 H.P., 3 Phase, 60 cycle, 220/440 volt, 1770 RPM Motor.

1—30 ton Carrier Air Conditioning Unit consisting of two—2 cylinder Compressors and two—15 H.P. Motors mounted on common base; with Kathabar Unit complete with all accessories, starters and instruments. Electrical characteristics 3/60/220/440. New 1942. Has been in use one season.

AIR COMPRESSOR

1—Ingersoll-Rand Compressor Type 40, 7" & 6¼" x 5" delivering 156 CFM at 100# with 40 H.P. Gen. Elec. TEFC motor, 3/60/220/440 volt, 900 RPM, Receiver and Control.

Heat and Power Co., inc.

70 PINE STREET — DIGBY 8-0373 — NEW YORK 5, N. Y.

"BREW, WOLTMAN OFFERS"

TURBINE UNITS—60 Cy.

2—6250 KW Gen. Elec. 25 Cycle, Cond.
1—4000 KW General Electric Cond.
2—3750 KVA Westinghouse Cond.
1—3750 KVA Westinghouse Extrac.
1—3125 KVA General Electric Cond.
1—2000 KW General Electric Non-C.
2—1250 KVA General Electric Cond.
1—1250 KVA DeLaval Cond.
2—1250 KVA DeLaval Non-C.
2—1250 KVA Elliott Cond.
1— 225 KVA General Electric Non-C.

STEAM ENGINE UNITS—60 Cy.

1—900 KW Hamilton Uniflow
1—750 KVA Chuse Uniflow
1—500 KVA Nordberg Uniflow
1—450 KVA Ames Uniflow
1—375 KVA Harrisburg Uniflow
1—312 KVA Murray Corliss
1—225 KVA Skinner Uniflow
1—187 KVA Ames Vertical
1—156 KVA Ames Vertical
1—150 KVA Harrisburg 4-valve
1—125 KVA Ames Uniflow

D.C. STEAM ENGINE UNITS

1—600 KW Skinner Uniflow, 250 V.
1—300 KW Skinner Uniflow, 275 V.
1—275 KW Ames Uniflow, 250 V.
1—200 KW Skinner Uniflow, 250 V.

DIESEL ENGINE UNITS

6—1600 HP Gen. Motors, 2400 V. 60 cy. gen.
3—1200 HP Hamilton 2300/4000 V. 60 cy. gen.
1— 720 HP Amer. Loco., 2400 V. DC.
1— 625 HP Worthington, 240 V. 60 cy. gen.
1— 480 HP Fairbanks Morse, 2400 V. 60 cy. gen.
3— 425 HP Gen. Elec. 440 V. 60 cy.
1— 400 HP Fairbanks Morse 2300 V. 60 cy.
3— 300 HP Gen. Motors 440 V. 60 cyl.
2— 30 KW Buda 6DTG-317, 3-60-127/220 V.

WATER TUBE BOILERS

2—748 HP Edgemoor 250-lb. Stokers
1—519 HP Titusville 200-lb. Stoker
6—509 HP Heine, 200-lb. Stokers
5—492 HP Heine, 180-lb. Stokers
2—469 HP B. & W. 425-lb. Pulverizer

SYNCHRONOUS MOTORS

1—6000 HP G.E. 60 cy. 2300 V. 90 RPM
2—2000 HP West. 60 cy. 2200 V. 120 RPM
1— 880 HP G.E. 60 cy. 6600 V. 514 RPM
1— 500 HP G.E. 60 cy. 2200 V. 720 RPM
1— 350 HP G.E. 60 cy. 2200 V. 720 RPM
1— 300 HP G.E. 60 cy. 2200 V. 600 RPM
1— 300 HP West. 60 cy. 2300 V. 900 RPM
1— 200 HP West. 60 cy. 440 V. 1800 RPM
1— 100 HP G.E. 2300 V. 240 RPM (Super)

INDUCTION MOTORS

1—8000/1000 HP Cr. Wh. S/R 2200 V. FL 895/448 RPM
1—1200 HP Allis Chalmers S/R 2200 V. 440 RPM
1—1000 HP West. S/R 2200 V. 360 RPM
1— 800 HP Allis Chalmers S/R 2200 V. 440 RPM
1— 300 HP West. S/R 2200 V. 1800 RPM
1— 200 HP G.E. S/R 2200 V. 435 RPM
2— 150 HP Al. Ch. 2300 V. 1800 RPM. NEW.
1— 150 HP Cr. Wh. 440 V. 1800 RPM. NEW.
2— 150 HP Burke S/C 440 V. 1800 RPM. NEW.
4— 125 HP Al. Ch. S/C 440 V. 435 RPM
1— 60 HP West. S/C 2300 V. 1200 RPM

MOTOR GENERATOR SETS

1—1500 KW Allis Chal. 600 V. DC 60 cy.
2—1000 KW Gen. Elec. 600 V. DC 60 cy.
1—1000 KW Gen. Elec. 275 V. DC 60 cy.
1— 500 KW Cr. Wh. 600 V. DC 60 cy.
1— 400 KW Cr. Wh. 275 V. DC 60 cy.
1— 400 KW Allis Chal. 275 V. DC 25 cy.
2— 300 KW Allis Chal. 275 V. DC 25 cy.
1— 300 KW West. 250 V. DC 60 cy. 3 Wire
1— 250 KW Allis Chal. 275 V. DC 25 cy.
1— 200 KW Gen. Elec. 60 V. DC 60 cy.
1— 192 KW West. 40/80 V. DC 60 cy.
2— 150 KW Elec. Mcy. 250 V. DC 60 cy.
1— 75 KW West. 125 V. DC 60 cy.
1— 50 KW West. 125 V. DC 60 cy.

ROTARIES—60 Cy.

1—2000 KW Allis Chalmers 600 V.
2—1000 KW Gen. Elec. 600 V.
1—1000 KW Westinghouse 240 V.
1— 750 KW Westinghouse 275 V.
1— 750 KW General Electric 600 V.
1— 500 KW Allis Chalmers 600 V.
1— 500 KW General Electric 275 V.
2— 300 KW Westinghouse 250 V.

FREQUENCY CHANGERS

1—2150 KVA G.E. 25/62½ cy. 750 RPM
1—1875 KVA G.E. 25/60 cy. 300 RPM
1—1200 KVA G.E. 25/60 cy. 300 RPM
2—1000 KVA G.E. 25/60 cy. 300 RPM
1— 938 KVA West. 25/62½ cy. 750 RPM
1— 600 KVA G.E. 60/25 cy. 300 RPM

TRANSFORMERS—60 Cy.

2— 833 KVA Al. Ch. 33000-4800 V.
3—3750 KVA West. 26400/13200-2400 V.
1—8000 KVA Penn. Auto 26400/13200-2400 V. 3 ph.
4— 333 KVA Al. Ch. 25410/44000-13280/23000 V
1—1000 KVA G.E. 24000-11500 V. 3 ph.
2—1000 KVA G.E. 23000-11500-575 V.
3— 750 KVA West. 22000-2300/4600 V.
3— 134 KVA G.E. 14400-2400 or 480 V.
3— 500 KVA West. 13200-2300/4600 V.
2—1000 KVA G.E. 11500/23000-575 V.
3— 167 KVA G.E. 7200/12400 Y-2400 or 480 V.
1—1500 KVA West. auto 4000-2300 V. 3 ph.
3— 167 KVA G.E. 2400/4160 Y-120/240 V.
3— 667 KVA G.E. 2300-575 V.
1— 400 KVA G.E. 2360-550 V. 3 ph.
1— 100 KVA G.E. 2300-575
3— 20 KVA West. 2200-575/287½ V.

OIL CIRCUIT BREAKERS

1—	400 A. 37 KV West. GII	Outdoor
2—	400 A. 25 KV G.E. FK0136	Outdoor
2—	1000 A. 23 KV Kelman CB76	Outdoor
2—	600 A. 15 KV G.E. FK255	Indoor
4—	600 A. 15 KV G.E. FHK0139-24BS	Outdoor

PARTIAL LIST—WE HAVE ALL CLASSES OF POWER EQUIPMENT

BREW, WOLTMAN & CO., INC.

50 Church Street New York City 7, New York

SYNCHRONOUS MOTORS

3/60/2200 Volts

2—50 HP, G.E., Type TS, .8PF, 600 RPM
1—150 HP, G.E., Type ATI, 1.PF, 900 RPM
1—500 HP, G.E., Type TS, .8PF, 720 RPM

3/60/440 Volts

1—60 HP, Type TS, .8PF, 1200 RPM
1—100 HP, Type TS, .8PF, 900 RPM

All the above motors are equipped with starting equipment.

THE MOTOR POWER CO. OF NEW YORK, INC.
859 Madison Ave.
New York 21, N. Y.
RHinelander 4-6478

POWER PLANT EQUIPMENT

Special Offerings

TURBO-GENERATORS

1—3500 KW 480 V Cond.
2—2500 KW 440 V Cond.
1—3000 KW 600 V Cond.
1—2000 KW 600 V Cond.
1—2000 KW 480 V. N. C.
2—1250 KW 2300 V Cond.
1—1500 KW 2300 V Cond.
2—1000 KW 440 V Extrac.
1—1000 KW 2300 V Cond.
1— 500 KW 240 V Cond.
2— 125 KW 220/440 V N. C.
1— 250 KW 2300 V N. D.
1— 125 KW 600 V Extrac.
1— 50 KW 220 V AC. N.C.

ENGINE GENERATORS

1—375 KW 2300 V Uniflow
1—168 KW 600 V.
2—280 KW 480 V.
1—250 KW 480 V.
1—150 KW 180 V.

TURBINES ONLY

1—375 H.P. with gears
1—210 H.P. Terry 250#

BOILERS

2—30,000# 425 PSI
1—1030 HP 225#
1— 500 HP 400#
4— 500 HP 200#
2— 480 HP 225#
2— 400 HP 180#
1— 250 HP 180#
2— 175 HP 200#
1— 150 HP 150#
1—100 HP 133# Scotch
1— 75 HP 150# New
1— 50 HP 200#

AIR COMPRESSORS

1—6000 CFM 50# Motor
1—2700 CFM 100# Motor
1— 700 CFM 100# Belted
1—5000 CFM 10# Rotary Type 440 V Syn. Motor
1—6000 CFM 5.1# New

TRANSFORMERS

3—200 KVA 600/220/110
3—1250 KVA 6600/600 V

Write or wire for additional data and prints.

A. LEE ELLIS CO., U. S. Machy. Bldg., 140 Federal St., Boston 10, Mass.

The Buyers Must Be Satisfied—Always

REBUILT POWER EQUIPMENT—READY TO SHIP

M.G. SETS

250 V. D.C. Motors 220/440 or 2200 v. 3 ph. 60 cy.

No.	KW	Make	Speed
1	3	West.	1350
1	5	G.E.	1750
1	5	West.	1150
1	7½	West.	1150
1	10	West.	1750
1	12½	West.	1750
2	15	West.	1750
1	15	West.	1150
1	20	G.E.	1150
1	25	West.	1150
4	40	West.	900
1 new	50	Burke hi-frequency	3600
2	50	West.	900
4	75	G.E.	600
1	75	G.E.	1750
1	100	Star	1200
1	100	G.E.	1200
1	100	G.E.	515
1	125	Star	1200
3	150	Star	1200
1	200	G.E.	1200

Can furnish M.G. Sets at 125 V. D. C. from 5 kw. up to 100 kw. for immediate shipment from stock.

DYNAMOMETER

"Hi-Eff" hydraulic size 35#, model 588, 3100 rpm., Taylor Mfg. Co.

FREQUENCY CHANGERS

3—25 kw., 220/440 v. 3 ph. 180 cy., G.E. dir. con. to 25 HP, 1800 rpm., 220/440 v. 3 ph. 60 cy. motors.

SPECIAL BARGAIN!

AIR COMPRESSORS

10—240 cfm Westinghouse, type 3 VS-23, 3 cyl. vert. 150# psi, dir. con. 50 HP., 220/440 or 2200 v., 3 ph. 60 cy., West. Slip Ring Motors. Equipped with automatic control. (Can furnish D.C. Motor if desired or Oil or Gasoline Engines)

SYNCHRONOUS MOTORS

1—New 500 HP., Elec. Machy. Co. 2200/220 or 440 v. 120 rpm.

INDUCTION HEATING CONVERTER

New Van Norman, type indoor, floor, hi-freq. 32 kw. 220 v. 1 ph., 60 cy. 150 A. enclosed type.

PUMPS

3—1000 GPM Worthington Cent. 1 stage, 6½" suc. 5" dis. 150# pres. dir. con. 133 HP., 875/1750 rpm., 230 v. DC Motors and control. (Can furnish A.C. Motors if desired.)

A.C. Motors—3 ph. 60 cy.

No.	HP.	Make	RPM		Volts
1	150	Fair. Morse	900	Hi-torque	2200
1	150	West.	1750	CS	2200
4	150	Louis Allis	1750	Splashproof	220/440
2	125	West.	680		2200/220/440
2	125	West.	580	CS	2200/220/440
1	125	Fair. Morse	900	JU	2200/550
2	100	West.	500	CS	2200/220/440
1	100	G.E.	900	KT	550/220/440
1	75	Stanley	600		220/440
6	75	Commonwealth	1200	P	220/440
1 new	75	Westinghouse	3600	CS	220/440
60 new	½	Diehl	1725	tot. enc.	220/440

GEAR HEAD MOTORS SPLASH PROOF BALL BEARING

50 HP., G.E. 220/440 or 550 v. 3 ph. 60 cy. 1755 to 13 rpm.
50 HP., G.E. 220/440 3 ph. 60 cy. 1755 to 317 rpm.
50 HP., G.E. 220/140 3 ph. 60 cy. 1755 to 72 rpm.

WINCHES

240—Winch assembly portable engine hoists, swivel hook, 4¾" l. with 1½" opening and 30' of ¾" cable. Hand cranked, double reduction gear with drum 5¾" w. can be used with A.C. or D.C. Motors.

25 Cycle MOTORS

2—300 HP. G.E. Slip Ring 2200 v. 3 ph. 375 rpm. with control.

D.C. GENERATORS

6—250 KW West. 240 v. D.C. 1200 rpm.

A.C. GENERATORS 3 ph., 60 cy.

KW	Make	RPM	Voltage
450	Elec. Machy.	120	220/440/2300/4000

SLIP RING MOTORS 3 ph. 60 cy.

2—700 HP G.E. type MT-415 2200 V. 900 rpm.
2—600 hp. G.E. type MT—2200 V. 900 rpm.
2—400 hp. G.E. type MT—2200 V. 900 rpm.
1—200 hp. West. type CW, 220/440 v. 1800 rpm.
1—150 hp. G.E. type MT. 549, 220/440/550 v. 1800 rpm.
1— 75 hp.G.E. type I form M, 220/440/550 v. 600 rpm.
1— 75 hp. G.E. type MTO, 220/440 v. 1165 rpm.
1— 50 hp. G.E. type MT, 220/440/550 v. 600 rpm.
10— 50 hp. West. type CW, 220/440/2200 v. 860 rpm.

WELDING AND PLATING SETS

1—Chandeysson 50 KW., 40 V. D.C. 600 rpm., 75 HP. Synchronous Motor 220/440 v. 3 ph. 60 cy., with exciter 100% P.F.
1—Thompson Shell Welder including West. control, 6 electronic tubes, ½ HP. A.C. Motor.
1—Federal special seam welder 200 kva., 2200/440 v. 60 cy. 5 DC max. sec. amps. 34000 at ¼ x 33 throat, sec. volts 5.1 10.2 max. air pres. 90 min. water inlet pres. 65# 70 deg. F. max.
1—Federal seam welder 150 kva., 220/440 v. 60 cy., .5 DC max. sec. amps. X30,000 at 4 BY-28 throat sec. volts 4-8 max. air pres. 90 deg. min. water inlet pres. 50 lbs. at 70 deg. F. 1 HP. AC Motor.

POWER PLANTS

5—NEW 1½ kw. Homelite portable 115 v. 1 ph. 60 cy. 1 cyl. air cooled 2 cycle gas or gasoline.
2—10 kw. 120/v. Star Generators dir. con. to Hercules DIESEL, 250.
1—25 kw. 120/208 v. 3 ph. 60 cy. 80% P.F. West. Gen. dir. con. to Le Roi Gasoline Engine.
2—30 kw. 125 v. G.E. Generators dir. con. Buda DIESEL.
1—35 kva. Ridgway 220/3/60 dir. Con. Ridgway STEAM engine.
1—125 kva. West. 240/480 v. 3 ph. 60 cy. West. dir. con. Erie Ball STEAM Engine.

TRANSFORMERS

24—NEW 25 kva. Allis Chalmers 440 v. primary, 110/220 v. 1 ph. 60 cy.

WRITE, WIRE OR PHONE YOUR ELECTRIC NEEDS—SEND FOR STOCK LIET. LIST YOUR IDLE EQUIPMENT WITH US

Duquesne Electric & Mfg. Co. Pittsburgh 6, Pa.

MOTORS • GENERATORS • TRANSFORMERS

MOTORS

3 PHASE—25 CYCLE—220 440 VOLTS

H.P.	Make	Type	Frame	RPM
5	West.	CS		750
5	West.	CS		750
5	West.	CS		750
5	West.	CS	453	750
5	West.	CS	453	750
5	G.E.	KT	948	1430
5	G.E.	KT	948	1430
5	G.E.	KT	948	1430
10	G.E.	KT	312	750
15	G.E.	I Form K		750
15	West.	CS	573	750
20	West.	CS		730
25	West.	CS		730
40	G.E.	I Form K		750
75	G.E.	I Form K		500
100	G.E.	I Form K		750
100	West. (2200 v.)	CS	871/526	460
125	West (S.R.)	CW		480
150	G.E.	I Form K		365
150	G.E. (2200 v.)	I Form K		750
150	G.E. (2200 v.)	I Form K		750
150	Allis Ch.	Slip Ring		720
150	G.E. (2200 v.)	KT b.b.	557Y	1470
200	West. (2200 v.)	CS	1013	480
200	G.E. (2200 v.)	I Form K		485
200	G.E. (S.R.)	I Form M		480
200	West. (S.R.)	CW	1011	480

2300 VOLT PRIMARY CONTRACTORS

1—225 HP. Square D Magnetic Controlled, 3/60/2200 Volts.
1—200 Amp Schweitzer-Conrad Load Break, 3 Pole Fused, 3/60/2200 Volts.

FREQUENCY CHANGERS

All Sizes in Stock. 60 cycle to 90 cycle. 100 cycle, 120 cycle, 180 and any other high cycle if desired.

HORIZONTAL & DUPLEX

Compressors & Vacuum Pumps after Coolers, Filters

25 CYCLE MOTORS

1—1270 HP. Gen. Elect. Synchronous Motor Type A.T.I. 3/25/2200 Volts 150 RPM.
1—1900 HP. Gen. Elect. Synchronous Motor Type A.T.I. 3/25/2200 Volts 150 RPM.

MOTOR GENERATOR SETS

2—350 KW General Electric Sets 250 Volts D.C. driven by 500 HP 3 Phase 25 Cycle motors.
1—30 KW Gen. Elec. Generator, Type DLC-203, 125 v. direct connected to 40 HP Gen. Elec. Motor, 3/440, 60/720 RPM with panel board.

ROTARY CONVERTER

1—2000 KW Westinghouse Booster type Rotary Converter 230 Volt D.C.—3 to 6 Phase, 25 Cycle, 4600 Volt Transformer.

NEW MOTORS

300 New Gen. Elect. & Westinghouse Motors in stock from 1 to 100 H.P.

MOTORS

1—75 HP. Gen. Elect. Type I Form K., 3/60/440/720 RPM.
1—75 HP. Fynn-Weischel Synchronous 3/60/440/1200 RPM.
1—75 Gen. Elec. Slipring Type I Form M., 3/60/440/450 RPM.
1—100 HP. Gen. Elect. Type K (New Motor) 3/60/440/1800 RPM.
1—100 HP. Westinghouse Slipring Type CW, 3/60/440/435 RPM.
1—100 HP. Gen. Elect. Slipring Type I Form M, 3/60/440/2200/720 RPM.
1—100 HP. Westinghouse Motor Type CS-867A, 3/60/440/885 RPM.
1—100 HP. Westinghouse Slipring Type CW 3/60/440/1200 RPM.
1—170 HP. Crocker Wheeler Slipring 3/60/440/600 RPM.
1—200 HP. Gen. Elect. Slipring Type I Form M. 3/25/440/500 RPM.
1—500 HP. Allis Chalmers Slipring 3/60/2200/514 RPM.
1—500 HP. Gen. Elect. Type I Form K, 3/25/440/485 RPM.
1—600 HP. Westinghouse Motor Type CS, 3/25/550/490 RPM.
1—600 HP. Gen. Elect. Slipring Type MT, 3/25/550/490 RPM.
1—1500 HP. Allis Chalmers Synchronous, 3/60/2200/164 RPM.

ERIE ELECTRIC CO., INC.

124 CHURCH ST. BUFFALO, N. Y.
CL. 4758

LATEST

DESIGN

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PROMPT

SHIPMENT

TRANSFORMERS

General Electric, Spirakore, type HS, 167 KVA, 2400/4160Y volts primary, 120/240 volts secondary, single phase, 60 cycle, oil cooled.

Alternative with the same rating except having a secondary voltage of 240 or 480.

GLOW ELECTRIC CO.

927 HARRIET
Cincinnati 3, Ohio

CRANES-MOTORS and ELECTRICAL EQUIPMENT

ENGINEERED AND REBUILT BY SPECIALISTS IN OUR MODERN PLANT

SYNCHRONOUS MOTORS
3 PHASE, 60 CYCLE

Qu.	HP.	Make	P.F.	Volts	RPM.
1	30	Whse.	.8	220	1800
2	50	G.E.	.8	2200	660
1	60	G.E.	.8	440	1200
1	100	G.E.	.8	440	900
1	100	Whse.	1.0	2200	1200
1	125	Whse.	.8	220/440	1200
1	150	G.E.	.8	440	900
1	150	G.E.	1.0	2200	900
1	500	G.E.	.8	2200	720

CAN FURNISH ABOVE WITH EXCITERS. REDUCED VOLTAGE MAGNETIC OR SEMI-MAGNETIC OR FULL VOLTAGE MAGNETIC CONTROLLERS.

A. C. GENERATORS

Kva.	Make	P.F.	Volts	RPM.
25	Whse.	.8	220/127	1800
125	Whse.	.8	220/440	1200
200	C.W.	1.0	600	720
200	C.W.	.8	240	600

32 KW G.E. Frequency Convertor, 220/3/60-Cy. to 110-V., 180-Cy.

SQUIRREL CAGE MOTORS
3 PHASE, 60 CYCLE

Qu.	HP.	Make	Type	Volts	RPM
1	20	G.E.	I-K	220	565
1	20	Whse.	CS	550	1740
8	20	Rel.	C504	440	
			1745/1150/875/570-RPM.		
2	25	Howell	M445	440	
			1770/1170/490-RPM.		
1	25	G.E.	KTR542	220	575
2	25	G.E.	KT332	220	865
1	25	G.E.	I-K	220	1200
1	30	Whse.	CS	550	900
1	35	G.E.	I-K	2200	1200
2	40	Al. Ch.	AR	440	860
2	40	F.M.	H12C	440	1200
1	40	Whse.	CS659A	2200	1760
1	50	G.E.	I-K	440	695
1	50	Whse.	CS	220	900
1	50	G.E.	KT536	440	1200
1	50	Ideal	AT445	440	1750
1	60	Whse.	CS607	440	800
1	75	Whse.	CS	440	1750
3	75	Al. Ch.	AR	2200	1765
1	100	G.E.	I-K	2300	695
5	100	F.M.	HS201C	440	880
2	100	Whse.	CS760	2300	1170
2	125	C.W.	126Q	440	430
2	125	Al. Ch.	AR	440	435
1	125	Whse.	CS761C	440	1800
3	125	Al. Ch.	AR	2200	1750
2	135	G.E.	KF542	440	1200
1	150	G.E.	I-K	2200	720
1	250	Whse.	CS	2200	1200

SLIP RING MOTORS
CONSTANT DUTY
3 PHASE, 60 CYCLE

Qu.	HP.	Make	Type	Volts	RPM
2	5	Al. Ch.	ARY	220/440	720
2	10	G.E.	IM	220	1150
2	15	G.E.	IM	220	1150
1	20	G.E.	MT326	220	850
2	25	G.E.	MT332	550/2200	850
1	25	Al. Ch.	ARY	2200	860
4	25	G.E.	MT526	440	900
2	25	Whse.	CW481	440	1750
1	30	Al. Ch.	ARY	440	900
1	30	Whse.	CW	440	1160
1	40	Al. Ch.	ARY	550/2200	435
3	40	G.E.	MT346	550	560
1	40	Whse.	CW644	220	870
3*	40	G.E.	IM	600	1170
1	50	Al. Ch.	ARY	2200	490
2	50	G.E.	MT536	2200	1200
1	75	G.E.	MT548	440	1200
1	75	Al. Ch.	ARY	440	1750
1	100	G.E.	MT356	440	865
1	125	G.E.	MT558	2200	900
1	150	G.E.	IM	2200	1750
1**	200	G.E.	IM	2200	580
1	200	Whse.	CW873	440	1175
1	250	Whse.	CW1106	2200	580
1	300	G.E.	MT412	2200	360
1	300	Al. Ch.	ARY	2200	514
1	300	G.E.	IM	2200	1200
1	400	Whse.	CW1108	2300	600
1	400	Al. Ch.	ARY	550/2200	514
1	800	Al. Ch.	ARY	2200	440
1***	1200	Whse.	CW	2200	590

*—40-Cycle. **—3-Bearing. ***—Mill Type.

Will supply with any of these motors Primary Control (O.C.B. or Mag.) Sec. Control, Drum or Mag., with necessary Resistance.

TRANSFORMERS
OIL COOLED

Qu.	K.V.A.	Make	Voltage	Ph.	Cy.
1	25	Al. Ch.	2300/460/230	1	60
3	25	G.E.	2200/1100/608	1	40
3*	37-½	Whse.	460/230-230/115	1	60
2	50	Wag.	13200/11880-575/287	1	60
1*	110	El. Fur.	2300-110/94/62/55	1	60
5	130	G.E.	19000/9500-550/2200	1	60
6	165/247	G.E.	38100/22000/11000-430/215		
			*	1	60
1	200	Whse.	3810/2200-440	3	60
3	300	Whse.	2400-480/240	1	60
1	500	G.E.	2400/240	3	60

*—Air-Cooled.

MOTOR GENERATOR SETS
3 PHASE, 60 CYCLE

Qu.	KW	Make	RPM.	DC. Volts	AC. Volts
1	5½	G.E.	1800	250	440
1	9	G.E.	1890	250	440
1	15	Al. Ch.	1200	250	440
8	25	Whse.	1200	120/240	440
4	25	Whse. (3-U.)	1200	120/240	440/2200
2	35	G.E.	1800	125	440
1	50	Lo. Al.	1200	120/240	440
1	75	Whse.	1200	125	440
2	94	G.E.	1200	60	440
1	100	Al. Ch.	900	125	2300
1	150	Rel.	1200	250	2300/4100
1	200	G.E.	1200	250	2300/4000

3-U.—3-Unit Set.

ABOVE FURNISHED COMPLETE WITH D.C. PANELS AND A.C. CONTROL EQUIPMENT.

T. B. MAC CABE COMPANY

4312 CLARISSA STREET — PHILADELPHIA, PENNA.

SLIP RING MOTORS
3-PH., 60 Cy.

HP	Volts	Make	Speed
200	2200, 440	G.E.	600
200	440/220	G.E.	720
125	440/220	G.E.	600
150	440/220	Whse.	1200
125	440/220	G.E. (Hoist)	900
100	440/220	G.E.	720
100	440/220	G.E. (MTC)	900
100	2200/440	G.E.	600
80	440/220	G.E. (MTC)	900
75	2200/550	G.E.	900
60	440/220	G.E.	1200
60	440/220	Cr. Wh.	720
50	440/220	G.E.	900
40	440/220	G.E.	720

SYNCHRONOUS MOTORS
3-PH., 60 Cy.

HP	Volts	Make	Type	RPM
400	440/220	G.E.	ATI	600
300	2200/440	G.E.	ATI	600
250	440/220	Whse.	HR	277
240	2200/550	G.E.	ATI	900
240	440/220	G.E.	ATI	720
200	4150/2300	Whse.	G	1800
200	2200	G.E.	ATI	514
150	4150/2300	G	G	1800
150	440/220	G.E.	ATI	900
150	2200/440	G.E.	TS	600
125	2300	G.E.	TS	327
110	440/220	G.E.	TS	300
110	440/220	G.E.	TS	257
100	440/220	G.E.	TS	900
100	440/220/25 cy	G.E.	TS	375
100	440/220	Whse.	G	1800
75	2200/440	Whse.	G	600
75	440/220	G.E.	TS	900

AIR COMPRESSOR UNIT
1—13" and 8" by 10" Worthington FEATHER-VALVE, 285 rpm, 110 lbs. ga., motor-driven, complete

CIRCUIT BREAKERS
1—2000 amp., ITE—3 pole—600 v., air circuit breaker
1—New 2500 amp., 600 v., type DA 75, 3 pole, Whse. air circuit breaker

SQUIRREL CAGE MOTORS

HP	Volts	Make	Type	Speed
600	2300/440	G.E.	KT	1200
500	440/220	G.E.	IK	900
400	550	G.E.	IK	720
300	2200/440	Whse.	CS	600
300	440/220	G.E.	KT	1800
200	2200/550	Cr. Wh.	SC	900
200	2200/440	G.E.	KT	1200
200	440/220	G.E.	IK	600
200	440	Whse.	CS	900
150	440/220	Howell	B. Brg.	1800
150 vert.	440/220	G.E.	KTP	1200
125 vert.	440/220	G.E.	KTP	1200
125	440	G.E.	KT	600
100	440/220	G.E.	KT	450
100	440/550	G.E.	KT	400
100	440	Whse.	CS	1800
75	440	G.E.	KT	360
75	550/220	G.E.	KT	1200
75	440	G.E.	KT	400

TURBO-GENERATOR
Generator, 125 kva. 1200 rpm. 440/220 v., Whse., dir. conn. by reduction gear to Turbine, 100 kw. 7380 rpm. non-condensing, 150/200 lbs. ga. pr., complete with dir. conn. exciter and switchboard; practically new condition, never used.

A. C. GENERATORS
1—320 kva., 600 rpm., 440/220 v., G.E.
1—300 kva., 600 rpm., 2200/440 v., G.E.
1—225 kva., 900 rpm., 2200/550 v., G.E.
1—225 kva., 720 rpm., 440/220 v., G.E.
1—190 kva., 514 rpm., 220/440 v., G.E.
1—150 kva., 900 rpm., 440/220 v., G.E.
1—100 kva., 327 rpm., 2300 v., G.E.
1— 98 kva., 1800 rpm., 440/220 v., G.E.
2— 75 kva., 1800 rpm., 440/220 v., Whse.
2— 75 kva., 1200 rpm., 440/220 v., G.E.
2— 30 kw., 1200 rpm., 440/220 v., G.E.

MOTOR GENERATOR SETS
1—125 kw., 250 v., 1200 R. Cr. Wh. conn. to 200 hp. 2200/440 v., 3 ph., Sq. C. motor.
1—100 kw., 125 v., 1200 rpm. Whse., conn. to 150 hp. 440/220 v., 3 ph. syn. motor.
1—75 kw., 250 v., 1200 rpm. Whse., conn. to 112 hp. 440/220 v., sq. cage motor.
1—60 kw., 125 v., 1200 rpm. Whse., conn. to 75 hp. 440/220 v., 60 cy., syn. motor.
1—25 kw., 440/220 v., 1800 rpm. G.E. alternator conn. to 40 hp. 230 v., DC motor.

TRANSFORMERS
60 Cycle
1—1000 kva. Al. Chal., 2400-120/240/208 volts, 3 phase. NEW.
1—400 Kva. G.E. 2300-230/115 v.
3—200 kva. Al. Chal., 2400-120/240 volts. NEW.
1—150 kva. Whse. SK. 13200-125/215 v. 3 ph.
6—100 kva. G.E. 4600/2300-230/115. NEW.
3—50 kva. Whse. 4600/2300-230/115.
6—37½ kva. Whse. 440-115. DRY.
3—25 Kva. G.E. 7200-120/240. NEW.
3—25 kva. G.E. 2300-230/115. DRY.

STEPHEN HALL & CO.

HARRY J. RICE PRES.

458 SEVENTH ST. HOBOKEN, N. J.

TURBO GENERATORS and BOILERS

1000 KW., 3 phase, 60 cycle, 480 volt, 3600 RPM., General Electric, rigid frame type non-condensing, 160 lbs. and 25 lbs. back pressure.

750 KW., 3 phase, 60 cycle, 2300 volt, 3600 RPM., Gen. Elec. rigid frame type, non-condensing 125 lbs. and 5-10 lbs. back pressure.

750 KW., General Electric rigid frame type 3600 RPM., 150 lbs. extraction 10 lbs. Generator can be wound for 220, 440, 550 or 2300 volts.

1—500 KW., 3 ph., 60 cy., 440 volt, 3600 RPM, Gen. Elec. to turbine #39937 nozzled for 185 lbs., condensing with Ingersol Rand Surface Condensor, etc.

6—400 HP steel encased water tube Heine boilers. Cross drum type.

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Power Plant Equipment Company

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3 COMPLETE, MODERN
575 KVA SKINNER UNAFLOW
ENGINE GENERATOR UNITS

3—750 H.P. Skinner unaflow engines, each directly connected to 575 KVA Westinghouse 220-volt, 3-phase, 60-cycle, 150-RPM alternating current generator, with 15-KW "V" BELT-DRIVEN EXCITERS.
Complete switchboard control apparatus, with switchboard-operated variable speed synchronizing devices and automatic voltage regulators.

ALSO AVAILABLE:

3—surface condensers with motor-driven circulating pumps.
3—250-HP low-pressure condensing steam turbines with auxiliaries.
This plant is one of the most modern medium-size steam power plants on the West Coast. It is complete in every detail.
The units were installed in 1935 and furnished complete power service for the building and presses of the Los Angeles Times. The plant has always been well maintained and is being removed from the Times Building now only because it is too small to furnish power for the building which is being enlarged to double capacity.
This complete steam power plant is offered for immediate shipment, F.O.B. Los Angeles. For further information, write or phone.

(See illustrated advertisement in Mid-December issue of this magazine)

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STEAM TURBO UNIT
60 CYCLE
For Immediate Delivery

1—3000 K.W., 3750 KVA. Westinghouse CW 46, 2 Stage Reaction Type Single Flow Condensing Turbo 150/200# steam pressure, Alternator 3 phase, 60 cycle, 2300 volts, 3600 RPM.

Unit recently entirely overhauled by manufacturer.

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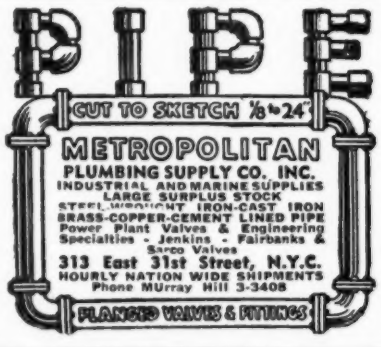
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Phone MUrray Hill 3-3408
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DARIEN CORP.,
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NEW ILG MARINE BLOWER FANS
24"—6250 C.F.M. 33"—10000 C.F.M.
36"—13000 C.F.M.
Axial Flow—Propeller Type. Driven by 230 volt DC Meters.
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V-BELT DRIVES
ELECTRIC HOISTS

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P & H HOISTS
M-G SETS
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Steam Engine with alternator direct connected 100 KVA 220 volt 3 phase, 60 cycle.

2 Babcock & Wilcox straight tube boilers 160 and 250 H.P. Oil burning pressure 150 lbs.

Motors, 3 phase 60 cycle 220/440 Volt, 1140 and 1750 RPM. All Sizes, ½ to 30 H.P. New and used.

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Large Complete Stocks ⅛" to 24"

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DIESEL ENGINES REBUILT

HP		MOD.	CYL.
50	International	UD-9	6
120	Busch Sulzer	B	6
130	Caterpillar	D-13000	6
135	Murphy	ME-6	6
135	Fulton	L	4
150	Fairbanks	HD-44	5
165	Busch Sulzer	B	6
170	Caterpillar	D-17000	8
180	Fairbanks	35-F	6
240	Fairbanks	32	4
360	Fairbanks	32	6
365	Busch Sulzer	B	6
480	McIntosh	5B33	5
1250	Nordberg	EG	5

Above engines w/or without generators & switchgear. Also have large stock of Elec. Motors, Pumps and Steam Equipment.

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MOTORS—GENERATORS—MG SETS—TRANSFORMERS—CONTROLS

LARGE STOCK OF A.C. and D.C. MOTORS!

SLIP RING MOTORS—3 Ph., 60 Cy.

Qn.	H.P.	Speed	Volts	Make	Type
1	3	1750	440*	West.	CW-232C
1	5	580	220*	G.E.	H1-9
6	7½	810	550	G.E.	MTC-5201
1	7½	575	220*	G.E.	MT-522
2	10	1149	440*	West.	HF-7A
2	10	570	220*	G.E.	HI-11
3	11‡	810	550	G.E.	ITC-5008
2	15	570	220*	West.	CW-646
1	18	680	440*	West.	MW-316
1	20	860	440*	West.	CW-638
1	25	1130	550	G.E.	MT-323
2	25	850	220*	Wagner	BR
2	25	720	440*	Wagner	22VBR
1	30	865	440*	West.	CW-646
1	30	850	440*	G.E.	MT-332
1	30	675	440*	G.E.	MT-336
2	35	600	440*	F-M	HV-H16A
2	40	865	2200	Al.-Ch.	ARY-223C
1	40	560	440*	G.E.	MT-346
1	50	869	440*	West.	HF-12A
5	52‡	550	220*	G.E.	IQC-5013***
1	60	685	440*	West.	CW-758
1	60	570	550*	G.E.	MTC-5546
1	60	345	550	West.	CW
1	75	720	550	G.E.	MT-556
1	80‡	575	440*	G.E.	MTC-5352
2	125	430	440*	G.E.	IL-16
2	150	1750	440*	G.E.	MTP-549
1	150	900	440*	G.E.	M-6334Z
1	175	505	550	West.	CW-1002
2	200	600	550	G.E.	IM-17
1	200	495	2200	G.E.	IM-17A
2	250	880	2200	G.E.	IM-17A
3	250**	360	440	West.	CW-20-53-15
3	300	900	440*	G.E.	IM-17
1	300	514	550	G.E.	IM-17A
1	400	505	550	West.	CW
1	700	720	2300/4000		West. CW

* Can be furnished for either 220 or 440 volts but not both voltages.
‡ Intermittent rating. *** 2 phase.
** New.

230 VOLT CONSTANT SPEED D. C. MOTORS

Qn.	H.P.	Speed	Make	Type
22	2	850	West.	SK-20
20	3	1150	West.	SK-20
10	3	850	Reliance	T-23T
25	3½	850	West.	SK-30
3	7½	1750/1310	West.	SK-43
2	7½	1150	G.E.	CDM-66
2	7½	875/1750	West.	SK-631
3	7½	850	G.E.	CD-75
5 (new)	10	1150	Al.-Ch.	EB-80
1	10	850	West.	SK-83
10 (new)	12½	600	West.	SK-93
5	15	825	West.	SK-90
1	20	1750/1310	West.	SK-83
2	20	1150	G.E.	RC-30
11	20	750	West.	SK-110L
17	25	825	West.	Sk-120
1	30	750	G.E.	RC
1	40	1700	West.	SK-103
1	40	750	G.E.	RC-34
1	50	650	G.E.	RC-16
2	60	1750/1310	West.	SK-143
3	75	850	West.	SK-160
1	150	700	Al.-Ch.	
2	200	1150	G.E.	RC-38
1	250	1150	C.W.	CMC-101A

VARIABLE VOLTAGE DRIVES

40 HP. Reliance, Variable Voltage Drives, each Consisting of:
1—40 KW. 250 Volt. Induction M-G Set, with two auxiliary 5 KW generators and exciter.
1—40 HP. 400/1500 RPM, Frame 385T, 230 Volt, DC Motor.
With full magnetic control providing jog forward, jog reverse, run, fast, slow, and stop, and motor operated field rheostat.

SQUIRREL CAGE MOTORS—3 Ph., 60 Cy.

Qn.	HP	Speed	Volts	Make	Type
4	1½	1140	440*	West.	CS-225-TEFC
10	3	1730	440*	G.E.	K-254-TEFC
4	7½	1740	440*	G.E.	K-284-TEFC
1	7½	1150	220*	G.E.	FTR-952
1	10	1730	440*	G.E.	KF-324-TEFC
1	10	1140	440*	Wagner	CP2-326-TEFC
1	10**	880	220*	West.	CS-365-EX-PF
1	15	3485	220*	Reliance	AA-B3247
1	20**	3475	220*	West.	CS-326
2	20	1169	440*	West.	CS-554
4	25	1170	220*	L.A.	JX-405-TEFC
1	25	1140	2200	West.	CCL
1	25	900	220*	Howell	SCRB-356***
1	25	705	440*	West.	CS-W504-TEFC
1	30	1160	440*	West.	CS-644
1	30	870	220*	West.	CS-546
1	40**	3545	220*	G.E.	KF-4048
3	40	1750	440*	West.	CS-583-C
1	40	1200	440*	G.E.	KT-332
3	40	1175	220*	G.E.	K-445
2	40	900	2200	G.E.	FTR-536
1	40	1765	220*	West.	CS-444-TEFC
5	50	1160	220*	G.E.	K-504
1	50	850	220*	West.	CCL
2	60	900	440*	G.E.	KT-346
1	75	1750	2200	West.	CS-761
1	75	1160	440*	West.	CS-662-C
1	100	890	220*	West.	C
2	100	890	2200	West.	CS-930
1	100	495	2200	Al.-Ch.	AN
2	125	890	2200	G.E.	I-17-R
1	150	1780	440*	G.E.	K-547
3	150	1175	2300*	G.E.	KTP-557
4	200	580	550‡	G.E.	KT-5668
4	350	1750	2300	G.E.	K-559
1	500	1200	440*	G.E.	KTP-567
1	700	1800	2300/4000	West.	CS-4-39D-12

* Can be furnished either 220 or 440 volts but not both voltages. ‡ Reconneetable for 440 volts.
** New. *** 2 phase.

230 VOLT ADJ. SPEED D. C. MOTORS

Qn.	H.P.	Speed	Make	Type
10	1½/2	500/200	G.E.	CD-65
1	2	225/900	Reliance	78T
2	6	450/1800	G.E.	RF-9
6	5/7½	660/1800	G.E.	RA-30
1	12½	280/840	West.	SK-130
10 (new)	12½	600	West.	SK 93
1	15/20	500/1500	G.E.	CD-95
1	20/25	300/1200	West.	SK-153
1	23/29	300/1200	G.E.	RF-13
1	30	400/1200	West.	SK-163
1	35	500/1500	West.	SK-143
2	40/50	400/1600	Al.-Ch	EB-147
1	75	500/1500	Cr.-Wh.	CCM
1	75	375/750	Cr.-Ch.	CMC-125H
3	100	225/900	G.E.	MPC-A
5	100	400/1200	Al.-Ch.	
1	100	320/960	West.	SK-200
1	175	230/750	West.	SK-220
2	375	350/500	G.E.	MPC

CRANE, MILL TYPE 230 V. D. C. MOTORS

Qn.	H.P.	Speed	Make	Type
2 (115 v.)	3½	700	G.E.	CO-1803
2	5½	760	West.	MCB-20
1 (new)	10	650	G.E.	MD-403-BE
1	20	515	West.	K-6
3	25	590	Diehl	TE
2	35	750	G.E.	CO-1828
3 (new)	35	600	West.	CK-9
1	50	750	G.E.	CO-1829A
1	50	600	West.	CK-9
5 (new)	50	525	G.E.	COM-1830AE
1	59	470	G.E.	CO-2007
2 (new)	60	550	G.E.	COM-1831AE
4	65	450	G.E.	COM-1830

125 HP, 30/25 Cycle Motors

2—West. Type CS, Frame 871.52C, 125 HP, Cont 50°, 1750 RPM, 30 cycle, 1500 RPM, 25 cycle, 440 Volt, 3 Phase, Squirrel Cage Motors.

Above Items Represent a Partial Listing Only. Your Inquiries Will Receive Our Prompt Attention. All Equipment is Located in Our Cleveland Warehouse. We have Controls for Most Items Listed.

ELECTRIC GENERATOR & MOTOR CO.

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COMPLETE POWER PLANTS

STEAM - ELECTRIC - HYDRO - DIESEL

"Export Orders Carefully Executed"

1—850 HP Stirling Boiler 300#. New condition.

2—1040 HP Heine Boilers 200#
2— 470 HP Edge Moore 200#
2— 825 HP B&W Co. 200# Stirlings
3—400 HP 200# Erie City Boilers
1—30,000# B&W Boiler 425#
Other Water Tube & Fire Tube Boilers

1—2000 KW Westinghouse Condensing Turbo-Generator

2—7500 KW Turbos-Cond. General Electric
2—3000 KW Turbos-Cond. General Electric
2—2000 KW Turbos-Cond. General Electric
2—2500 KW Turbos Condensing
2—1000 KW Turbos Condensing
Several 500-750 Turbos and Smaller

Non-Condensing units up to 2000 KW.

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ALTERNATORS, ALL FREQUENCIES
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D. C. GENERATORS, ALL VOLTAGES
CONTROL EQUIPMENT

ALL SIZES
VOLTAGE AND CYCLES

3 ph. 60 cy. A.C. Motors
3 ph. 25 cy. Motors
125 Volts D. C. Motors
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Put all idle equipment to work. Send your list for prompt action. **WRITE OR WIRE YOUR INQUIRIES**

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1—500 KW G.E. 80/100 lbs. T.S.P. 10/15 lbs. B.P. non-condensing, 3 ph. 60 cy. 480v, dir. conn. exciter, panel & regulator

1—3000 KW Whse. 3750 KVA, 2300v, 3 ph., 60 cy. with Parsons 200 lb. cond. turbine

1—2000 KW G.E. 6600v, 3 ph., 60 cy. with 175 lb. cond. turbine and dir. conn. exiciter

1—1500 KW G.E. 2300v, 3 ph., 60 cy. with G.E. 225 lbs. cond. turbine, surface condenser

2—1250 KW G.E. 2300v, 3 ph., 60 cy. with 175 lbs. condensing turbine

1—1250 KW Al Ch. 2300v, 3 ph., 60 cy. with 200 lb. condensing turbine, surface condenser

1—1000 KW G.E. 2300/4150v, 3 ph., 60 cy. with 135/150 lb. condensing turbine

BELYEA COMPANY INC.

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ALSO N. Y. CITY LINE—RECTOR 2-7150

BOILERS

2—404 H.P. Springfield, oil burners 170#
1—550 H.P. W.W. sectional header 200#
4—300 H.P. Casey-Hedges, oil, 165#
2—25,000# Stirling's, pulverizers, 425#

Other sizes and types

H. P. BREARLEY
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FOR SALE

Power plant equipment. Steam, Diesel, electrical, boilers, engines, turbines, generators, new or used.

PENN MACHINERY COMPANY
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APPLICATION ENGINEERS

45 KW M.G. Set 2200 AC 250 DC
100 KW M.G. Set 220/440 AC 125/250 DC
285 KW 240 volt Chase Uniflow engine set
200 KW 480 volt Ridgway engine set
2500 KW 2300 volt G.E. Cond Turbine set
200 KW 1800 rpm 440 volt TEFC Motor

HOWARD B. JOHNSON & ASSOCIATES
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FOR SALE—LOW PRICE

2—175 H.P. at 200 R.P.M., approx., on 110# steam.

FITCHBURG STEAM ENGINES

Each 15½" x 14", Side Crank, Piston Valves, with Flywheels and Pulleys.

Designed for high speeds, up to 275 R.P.M. Originally operated at 125# steam. One is Right Hand, one Left Hand.

For further data contact

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Selling Agent
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FOR SALE

GENERATOR SETS

100 KW **200 KW**

General Motors Diesel engines, 8 cyl., Model 8-268A, 6½" bore x 7" stroke. Direct conn. to: 200 KW WESTINGHOUSE ALTERNATORS, 3 phase, 50 and 60 cy., 400/440 V., including switchboards.

ALSO—COMPLETELY REBUILT

3 cylinder General Motors Diesel Engine Sets Direct Conn. to: 100 KW CENTURY ALTERNATORS, 3 phase, 60 cy., 440 Volt, Inc. switchboards.

1800 HP Fairbanks-Morse, Model 38D 8⅛. 8⅛"x10", 800 RPM, 10 cyl., air start, solid injection, new 1943. Engine weight: 33,000 lbs. Complete with all auxiliaries, Rebuilt.

ALJOHN DIESEL Co., Inc.
904 Pacific St. Brooklyn 16, N. Y.
Sterling 3-6515

FOR SALE

1—250 KW GE turbo-generator unit, Steam conditions 525#. 350° superheat, condensing. Generator 3-phase, 60 cycle, 450-volts, 1200 RPM with 40 KW exciter.

Machine New in 1941

G. DeROSE
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Vacuum pump for sale

One—Beach-Russ high vacuum pump No. 750-D. Motor and required pulley also available. Condition perfect, practically new. Complete details upon request.

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etc., contact

PENN ELECTRICAL ENGINEERING CO.
Scranton, Pa. Established 1908

Buying
Good Used Equipment

is frequently the difference between having good needed equipment or doing without it.

MOTOR GENERATORS

500 KW G.E. SYN. 600 V. 2300/4000 A.C. 1200 RPM. 3 PH. 60 CY. COMPLETE MANUAL SWITCHGEAR.

400 KW WEST. SYN. 600 V. 2300/4000 A.C. 720 RPM. 3 PH. 60 CY. COMPLETE MANUAL SWITCHGEAR.

200 KW RIDGWAY SYN. 250 V. 2300/4000 A.C. 900 RPM. 3 PH. 60. COMPLETE MANUAL SWITCHGEAR.

Each unit listed above is owned by us and is available now for immediate purchase.

WALLACE E. KIRK COMPANY
502 Grant Building, Pittsburgh, Pa.

DIESEL and STEAM

450 HP Fairbanks Morse diesel. Type 32-E-14. 6 cyl. 375 KVA. 3/60/2300. Complete. New 1946.

750 KW GE condensing turbine 3 stage 3600 RPM. 3/60/2300 volts. Surface condenser. New 1925.

25 KW International Ready Power portable diesel generator set. 1/60/220 volts. Radiator, etc. Like new.

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AIR COMPRESSORS

2—175 CFM Inger.-Rand 2 cyl. vert. 150 P.S.I. Type XIV, dir. con. to G.E. 50 HP DC motor, 230 V. 400 RPM. Mounted on factory cast iron base. Complete with intercooler, unloader and access.

2—1500 CFM Penna. 110 P.S.I. horiz. 2 stage, Class DCE-2, with direct motor drive 300 HP Elec. Mach. syn. motor, 3 ph. 60 cy. 2300 V. 225 RPM, with intercooler and aftercooler and access. Request Bulletin D-100 for other compr. in stock.

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COMPRESSORS
Vacuum Pumps

New & Guaranteed Rebuilts
Stationary & Portable

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100 H.P. AMES ECONOMIC
ASME 125 LB. PRES. BOILER
60 FT. STACK & GRATES

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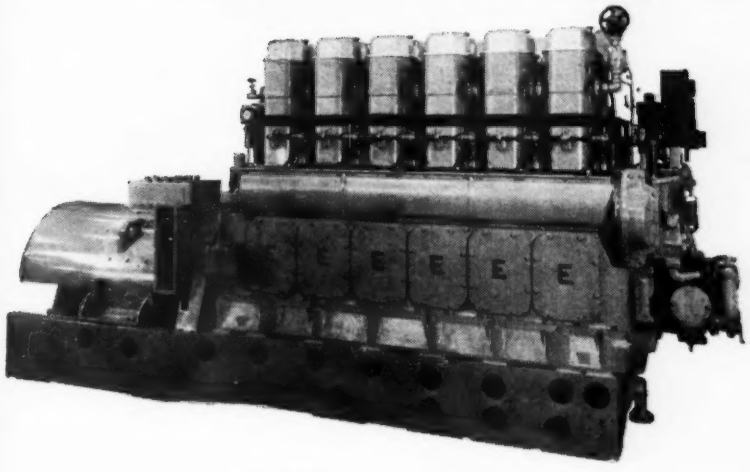
DIESEL GENERATORS



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COMPLETE GENERATOR POWER PLANTS

15—450 HP, Model DSG-6, 450 RPM, 12x15, 6 cylinder Diesel Engines direct connected to

15—250 KW. Elliott Direct Current Generators, 120/240 volt, 3 wire compound wound, 450 RPM. Complete with all necessary auxiliaries.

Large supply of brand new spare parts available

HP	MODEL	KVA	RPM	NEW	HP	MODEL	KVA	RPM	NEW
8—1600	General Motors 16-278A	1200	720	95%	10—225	Buckeye Model 80	180	600	new
1— 450	Fairbanks Morse 32F	375	360	95%	1— 180	Fairbanks Morse YVA	150	257	95%
1— 375	McIntosh Seymour	350	360	85%					
1— 365	Ingersoll Rand S	340	600	95%	3— 150	Worthington BB	125	600	99%
4— 360	Fairbanks Morse YVA	300	257	80%	2— 150	Buckeye Model E	145	400	95%
5— 350	General Motors 8-268A	250	1200	95%	1— 90	Cummins HIS 600	62.5	1200	new
1— 300	Buckeye Model E	250	400	90%	1— 80	Fairbanks Morse YVA	65	300	85%
2— 240	Fairbanks Morse YVA	200	257	85%	1— 75	Buckeye Model J	62.5	600	95%
					1— 40	Buckeye Model J	30	600	95%

Many other important Diesel offerings from 15 KW to 1000 KW

Diesel Motors

WE HELP TO LIGHT AND POWER THE WORLD

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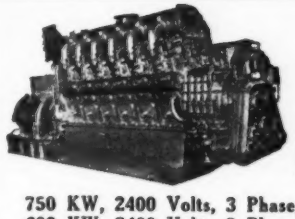

DIESEL
Generator Plants
For Immediate Delivery

HEMCO

750 KW, 2400 Volts, 3 Phase, 60 Cycle, 720 RPM, General Motors Model 12-567
600 KW, 2400 Volts, 3 Phase, 50 Cycle, 600 RPM, General Motors Model 12-567
300 KW, 450/2400 Volts, 3 Phase, 60 Cycle, 1200 RPM, General Motors Model 8-268A
200 KW, 450/2400 Volts, 3 Phase, 60 Cycle, 1200 RPM, General Motors Model 8-268A
125 KW, 220/440/2400 V, 3 Ph, 60 Cy, 1200 RPM, General Motors Model 3-268A
125 to 900 HP Diesel Driven Right Angle Pump Drive Units 900 to 1800 RPM.
125 KW, 220/440/2400 Volts, 3 Phase, 60 Cycle, 1200 RPM, Superior Diesel Model GDB-8
75 KW, 220/440 Volts, 3 Phase, 60 Cycle, 1200 RPM, Hercules Diesel DFXE
50 KW, 440 Volts, 3 Phase, 60 Cycle, 900 RPM, Fairbanks-Morse Model 36A 5½
100 KW, 3 Wire, 125/250 Volts DC, 1200 RPM, General Motors Model 3-268A
900 HP, General Motors Model 12-567, Propulsion Unit Complete

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250 KVA Fairbanks Morse 2300/440 v.—Style VA
225 KVA Wghse. 2300/440/220 v.—Worthington
187 KVA Fairbanks M. 2400/440/220 v. — Marine Type
156 KVA Ideal 240/480 v.—Buckeye
150 KVA GE 240/480 v.—Superior
93.8 KVA Electric Machinery—Superior
75 KVA General Motors 440/220 v.
62 KVA GE 220/120 v.—Gen. Motors
50 KVA Fairbanks M. 240 v.—Model 36A

TURBO UNITS (NON-COND.)

37½ KVA Westinghouse 240/480 v.
125 KVA General Electric 240 v.
155 KVA (2) Allis Chalmers 220/440 v.—Terry
250 KVA General Electric 220/440 v.
250 KVA General Electric 480 v. (400#)
250 KVA GE 600 v.—GE 30# BP
280 KVA General Electric 2300 v.—Terry
375 KVA (2) General Electric 2300 v.

TURBO UNITS (COND.)

750 KVA GE; 2300 v. 250#
750 KVA General Electric 240/480 v.
940 KVA Westinghouse 6600 v.
1250 KVA General Electric, 2300 v.
1250 KVA Westinghouse 2300 v.
1250 KVA General Electric 600 v.
1250 KVA (2) Allis Chalmers 4000/2300 v.
1875 KVA (2) General Electric 2300 v.
2500 KVA General Electric 600 v.

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250 HP Erie City 180#
254 HP (2) Sterling 200#
406 HP (2) Heine 180#
467 HP (3) Edgemoor 200#
469 HP (2) Sterling 425#
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507 HP Heine, bent tube, 400#
514 HP Erie City cross drum 200#
700 HP Sterling, 250#
1038 HP Springfield 200#

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79 KVA Allis Chalmers 480/240 v.—Ames Unif.
187 KVA General Electric 240/480 v.—Chuse 4 v.
187 KVA Westinghouse 240/480 v.—Ames Unif. Ver.
375 KVA General Electric 2300/440 v.—Chuse 4 v.
450 KVA General Electric 2300/440 v.—Ames Unif.
500 KVA Crocker Wheeler 240/480 v. — Nordberg Unif.
625 KVA General Electric, 2300/440 v. Skinner Unif.
688 KVA Allis Chalmers 600 v.—Al Chal. Corliss

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K.W. output 1. Cont. Duty Ph. Single
P.F. 80 Cycles 60
Volts input 115 D.C. Volts output 120 A.C.
Amps input 14 Amps output 10.4
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150 KW	General Motors or Buckeye	3/60/440 volt
200 KW	General Motors or Fairbanks-Morse	3/60/440 volt
300 KW	General Motors or Fairbanks-Morse	3/60/2400 volt
400 KW	General Motors or Cooper Bessemore	3/60/2400 volt
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60 KW Belted Generator 2300/120/220/440 V.
192 KW 2300/220/440 V. Gen. D/C Unaflow Eng.

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1—187.5 KVA Ames Vertical 480 V.
1—156 KVA Ames Vertical 480 V.
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10	5	1200	Al. Ch.	BB, Open
5	5	1750	Century	TEXP
12	10	1750	Al. Ch.	BB, Open
9	15	1750	Al. Ch.	BB, Open
3	15	3460	G.E.	SB, DP
9	20	1750	Al. Ch.	BB, Open
3	25	1160	Al. Ch.	BB, Open
5	25	1750	Al. Ch.	BB, Open
5	30	1750	Al. Ch.	BB, Open
3	40	1750	Al. Ch.	BB, Open
5	50	1160	Al. Ch.	BB, Open
4	50	1750	Al. Ch.	BB, Open
3	60	575	G.E.	SB, Open
2	125	1750	Al. Ch.	SB, Open

Reconditioned and Guaranteed INDUCTION MOTORS, 220/440 volts

1	20	1800	G.E.	Slip Ring
1	50	600	Ideal	Syn.
1	100	850	Wstg.	Slip Ring
10	125	456	Al. Ch.	Sq. Cage, BB
1	250	600	Lincoln	Slip Ring

Reconditioned and Guaranteed D.C. ADJUSTABLE SPEED MOTORS, 230 volts

4	15/20	400/1200	G.E.	RLC-203A, Shunt
1	15/20	600/1800	Rel.	131-T
1	20/25	400/1200	E.D.	
7	20/25	600/2000	G.E.	CD-105
1	25/30	500/1500	Rel.	Shunt
1	30/40	400/1200	G.E.	RLC-204
3	40	250/1500	G.E.	CD-1441
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360—G.E. Clamp on Heating Units, 2250 Watts, 115 V.

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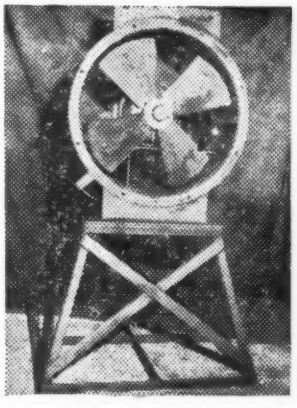

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Westinghouse Generator 500 Volt
720 RPM, Electric Start
Unused—Ready to ship

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904 Pacific Street Brooklyn 16, N. Y.
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24 Ton 37' Span 5 Motor
20 Ton P&H 37' Span 3 Motor
12 Ton Wood 37' Span 3 Motor

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800 HP Syn. Motors (2)

Elec. Machy., 1 PF 450 RPM 3/60/6600 (Now 2300) Two Bearing, Top Mtd. Exciter, #80216-7, Full Voltage West. Starters, Excellent Condition.

$6,500. - Ea.
FOB St. Louis.

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DIESEL GENERATOR COMPRESSOR COMBINATION

2000 C.F.M. with

344 K.V.A. ELECTRIC GENERATOR

DIESEL ENGINE:
Chicago Pneumatic Tool Co. 8 cylinder—400 H.P. @ 400 RPM.

direct connected to

GENERATOR:
Electric Machinery Mfg. Co. 344 K.V.A.—80% P.F. 3/60/220/440

clutch coupled to

COMPRESSOR:
Chicago Pneumatic Tool Co. Model WXO-4 cyl. Double Acting Vertical V-type Water cooled.

ACCESSORIES:
Starting compressor—air receiver—complete panel board — pumps — motors — meters—complete for operation.

We own and offer three of these unused units—in excellent condition—one never used

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1—300 KW. 1-200 KW. G. E. 3/60/240 v 3600 RPM. 150# & 5# b.pr. Complete, operated until recently

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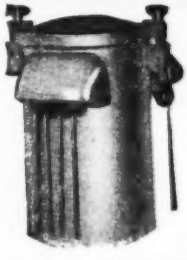

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TWO WATER WHEEL GENERATOR SETS

complete

2—425-Kva., 2200/3/60 generators each direct connected to horizontal, spiral case reaction type water turbines for 60′ head. This is a complete plant with direct connected exciters, oil pressure governors and six panel switchboard, also

3—475-Kva. 60/1 transformers 2200 volt to 13,200 volts with two panel switchboard to control the transformers. This is modern equipment, excellent condition.

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Horizontal Water Cooled—Any size also 2 Stage portable units

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One 150 KW Alternator

225 RPM 220 volt 3 phase 60 cycle for use on own engine.

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Bessler System Model 15,

63 HP rating, 400 to 1500 lbs. steam per hour. Easily adjustable for varying controlled pressures and tetmperatures.

Equipment consists of boiler, oil burner, boiler feed pump and motor, blower and motor, automatic fire and water control apparatus, and all necessary accessories for proper operation.

1—100 Gallon steam heated water still—

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Complete with all accessories including evaporator, cooler, condenser, separator, connecting piping, and 500 gallon water storage tank.

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HILLMAN, MICHIGAN

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AC Generator with Exciter

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steam by-pass. *Guaranteed condition.*

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Complete Plant

RILEY Watertube Boiler, 60,000# cap. 477# working & 150# operating pressure w/all equip. including Riley Pulverized Coal Furnace.
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SKINNER Uniflow Engine, 21" x 22".
GENERAL ELECTRIC 250 KVA AC Alternator.
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Other equipment including stokers, Troy Engine 8" x 8", Pulverizers, Fans, Tube Mills, Turbine Pumps, Conveyors, Tanks, Water Heaters, Steam ash handling system, coal hoppers, truck sales, etc.

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PARTIAL STOCK LIST AS OF MARCH 1, 1948

60 Cycle—Oil Type Transformers

	KVA.	P.V.	S.V.	Phase
(2)	2000	23000	2300	1
	1500	2200	600	3
	1000	2200	220	3
(3)	667	2300	600	1
	600	440	220	3
	540	680	82	3
(3)	500	13800	480	1
(6)	500	2400	240/480	1
(3)	500	2300	230/460	1
(3)	500	6600	575	1
(3)	333	1000	2300	1
(3)	333	2400	480/240	1
(3)	300	2400	240	1
(3)	300	2400	120/240	1
(3)	300	2400	120/240	1
	250	480	120/240	1
(50)	250	2400	220/440	1
	250	7200	240/480	1
	250	460	178	1
(3)	200	13800	240/480	1
(2)	200	12000	600	1
(3)	200	7200	120/240	1
(3)	200	4150	480	1
(3)	200	4000	480/240	1
	200	4000	115/230	1
(3)	200	2400	240/480	1
	200	550	440	1
	200	550	120/240	1
(2)	180	13200	125/220	1
(3)	150	2200	550	1
(3)	165	2400	240/480	1
(7)	150	2400	110/220	1
(3)	150	2400	220/440	1
(3)	150	33000	2300	1
(3)	150	2300	550	1
(3)	150	2300	230/460	1
	125	440	110/220	1
(2)	125	440	220	2/3
(4)	100	33000	2400	1
(3)	100	2200	550	1
(6)	100	2400	230/460	1
(2)	100	2400	600	1
(3)	100	2400	115/230	1
(3)	100	2400	115/230	1
	100	4000	115/230	1
(2)	100	440	115/230	1
(6)	75	220	110	1
(3)	75	2300	115/230	1
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(37)	50	2400	115/230	1
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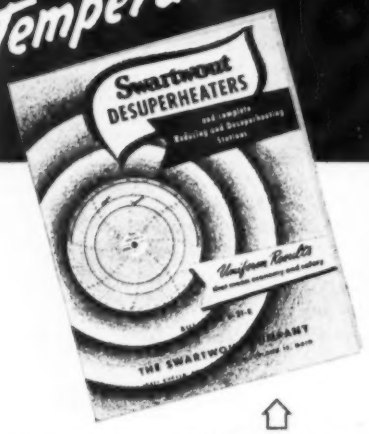
Pressure: $\pm\frac{1}{2}$#
Temperature: ±3°F

Accurate, safe control by Swartwout Reducing and Desuperheating



Write for this new Bulletin S-21-E describing Swartwout Desuperheaters and complementary controls.

This Swartwout Atomizer type desuperheater is part of the installation diagrammed below.

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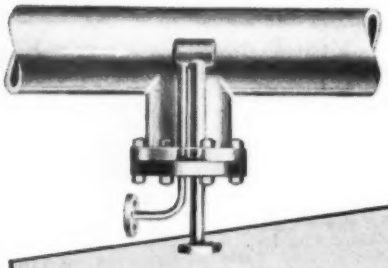

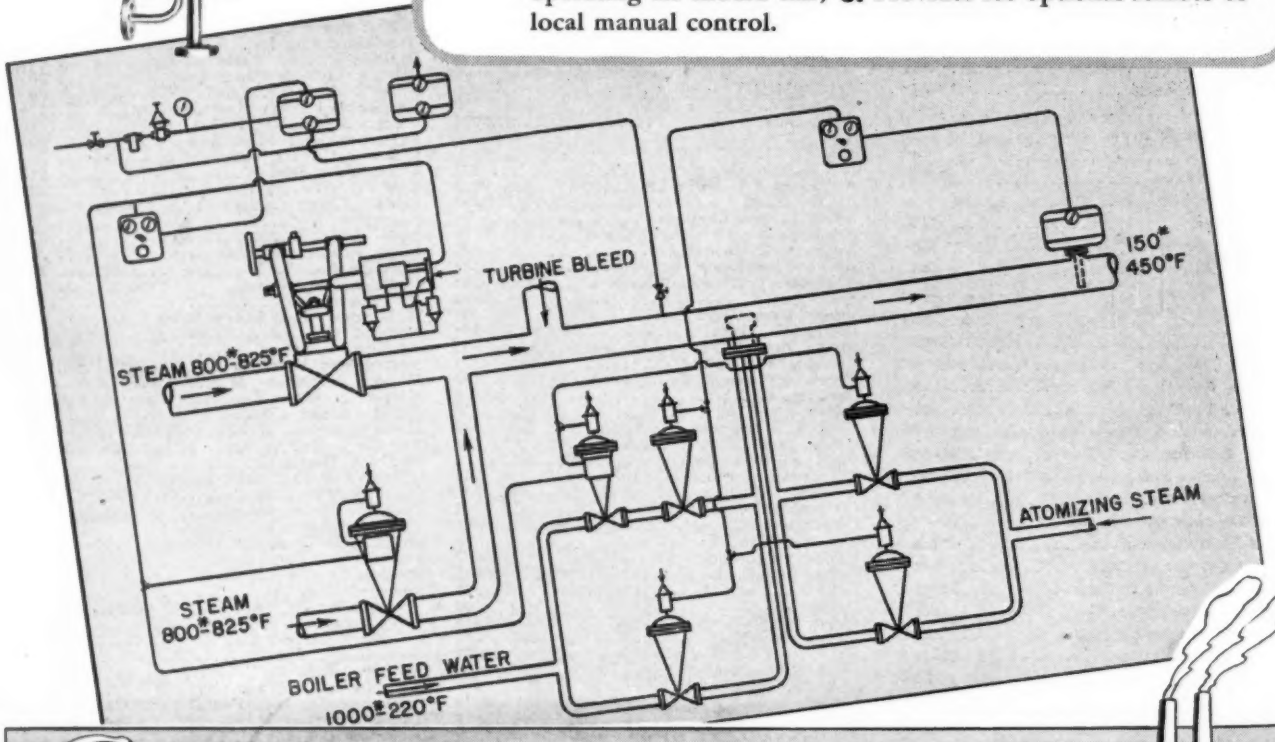

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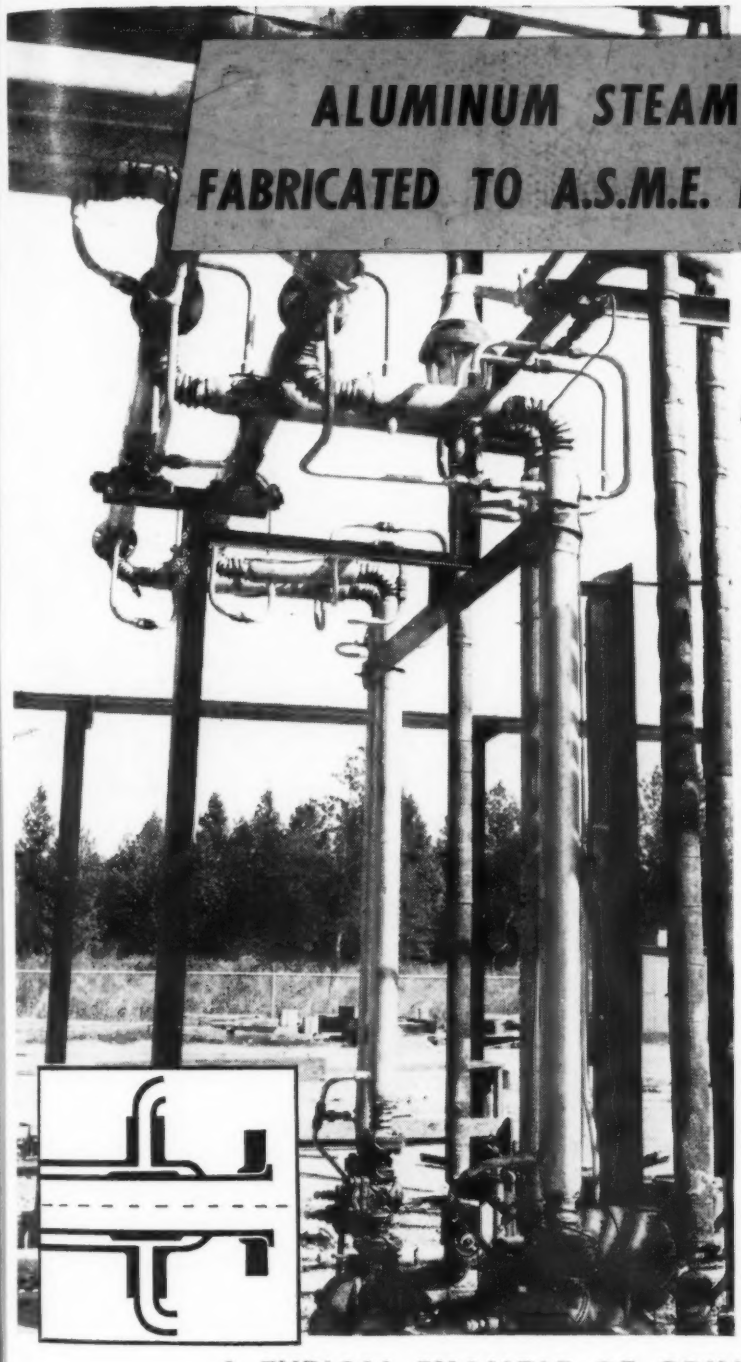

"It couldn't be done"... but Grinnell Metallurgical Research did it.

These *aluminum* steam jacketed lines with jumper connections and tracing lines were designed by Stone & Webster Engineering Corporation for Newport Industries of Oakdale, Louisiana. The specifications called for fabrication procedure to meet Section IX of the A.S.M.E. Boiler Construction Code for *steel* — a most unusual and strict requirement.

Experts said the job couldn't be done, but Grinnell metallurgical research developed processes for forming, drawing and welding *aluminum* to meet the requirements of a code intended for *steels.* Again Grinnell does an "impossible" job — on time — with sub-assemblies ready for installation with minimum field welding.

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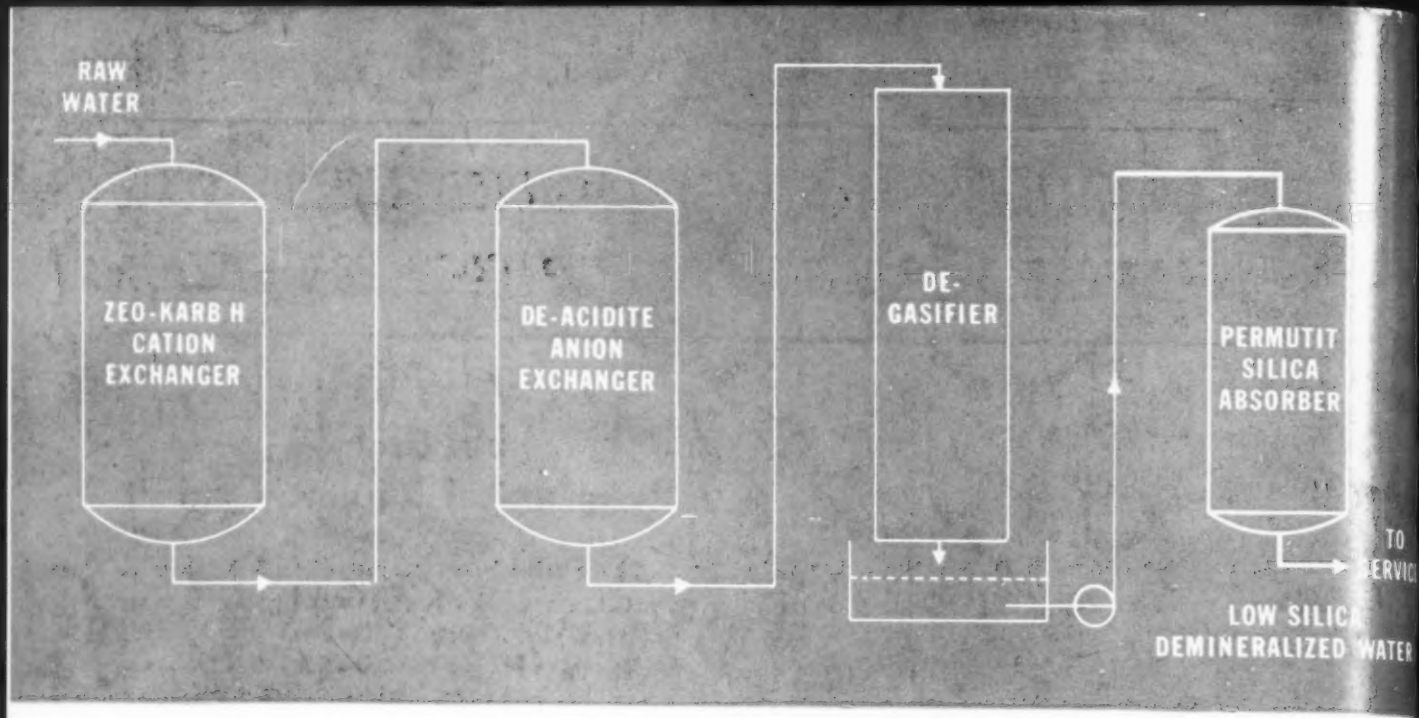

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